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ELECTRICAL WORLD

JULY 9, 1932

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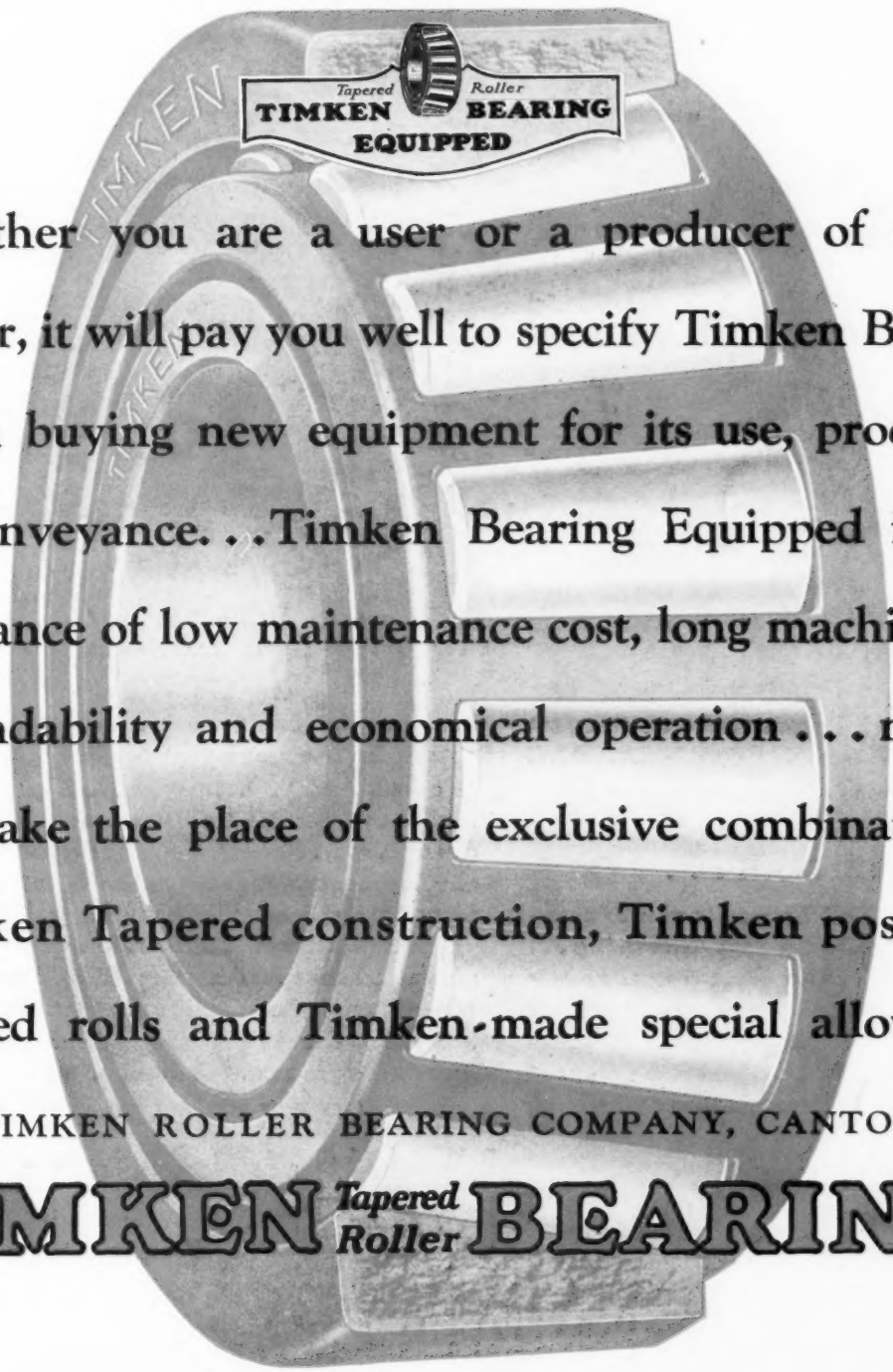

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WRITE FOR BOOKLET M-1

WESTON

ELECTRICAL INSTRUMENT CORPORATION

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ELECTRICAL WORLD

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for the Week Ending

July 9, 1932

Insull's Eastern Utility Properties Placed in Receivership

LIKELIHOOD of the dissolution of the National group of Insull holding companies grows as an auction of the securities of operating companies pledged with the New York Trust Company as collateral for a loan of $3,000,000 to the National Electric Power Company, now in receivership, is scheduled. The auction of the securities of the Chicago "Big Three" still hangs in abeyance after many halts in proposed proceedings through the efforts of Judge Lindley (ELECTRICAL WORLD, June 25, page 1080), but this later development may not be stopped.

The properties which are to be sold consist of all except directors' shares of the Penn Central Light & Power Company and Michigan Electric Power Company, direct subsidiaries of National Electric Power, and of the Tidewater Power Company, and a substantial majority of Florida Power Corporation shares. The latter two companies are controlled by Seaboard Public Service, itself a subsidiary of the National Public Service Corporation.

The New York Trust Company is credited in Wall Street with the intention of bidding in the collateral which it will offer at auction, and it is believed consequently that the National group will lose four of its operating companies at that time. For the properties to remain within the system, it would be necessary for a reorganization plan to be developed which would provide sufficient cash to enable the group to repurchase the operating companies from the trust compnay. That prospects of this are remote is the consensus of financial circles.

What action may be taken by other institutions holding National Electric and National Public Service properties as collateral is not known at this time.

Receiverships precipitated by July 1 interest

Receivers were appointed for the National Electric Power Company and its subsidiary, the National Public Service Corporation, principal Eastern properties of the Middle West Utilities system, on Thursday of last week. Charles A. McCulloch, one of the two receivers of the Middle West Utilities Company, and Gordon Auchincloss, New York lawyer, were appointed receivers for both companies. In addition, Philip S. Clifford was appointed third receiver of National Electric Power by the Supreme Judicial Court of Maine, where the company was incorporated, and Henry W. Anderson was appointed third receiver of National Public Service by the United States District Court for the Eastern District of Virginia, where that company was incorporated. This action followed a six weeks' study of the properties by Stone & Webster, engineers, made at the request of New York bank creditors and agreed to by the Middle West Utilities Company receivers.

Following the Middle West receivership proceedings, efforts were made (see ELECTRICAL WORLD, April 23, page 719) to set up the underlying properties as independent organizations. A month later (ELECTRICAL WORLD, May 25, page 916), banking interests, executives of the National Electric Power Company and receivers of the Middle West Utilities Company met to discuss plans for meeting the National Electric Power's maturing obligations. The plan which sought temporarily to care for the financial requirements of the holding companies in the Eastern set-up pending the development of a reorganization plan was not agreed to by the bankers. As no funds were available from other sources the only alternative method of holding the properties together was through receivership.

This Week

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What would families like to buy next? p. 38

Diesel energy costs range from 1.7 to 3 cents. p. 51

Iced comfort cooling makes power sales grow. p. 54

Pennsylvania commissioner faces Pinchot attack. p. 36

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Accidents and Lighting Linked in National Survey

As the result of a survey covering 46 cities, ranging in population from 100,000 to several million and totaling 25,000,000, for the year 1931, the Travelers Insurance Company has been able to study the influence of different seasonal, weather, light, traffic and road conditions as related to accident frequency.

It was found that the automobile-accident rate during the hours of 5 to 8 p.m. was higher than for any other three-hour period or combination of periods during the day. The report of the survey states: "The reduced ability to see is exacting a heavy toll. . . . Between the hours of 5 and 8 p.m. in

the four summer months there were 366 fatal automobile accidents and 9,516 additional accidents in which there were no fatalities. During the same hours in the four winter months there were 794 fatalities and 20,644 non-fatal accidents.

"There is a logical increase (due to seasonal and road surface conditions)," continues the report, "in the number of winter months' accidents over the number of summer months' accidents. Assuming this to be 10 per cent and adding it to the number of fatal accidents we still have an increase of 392 fatal and 10,177 non-fatal accidents for the winter period. There seems to be no other conclusion but that this is due largely, if not wholly, to inadequate illumination.

"We estimate the increased economic loss (winter over summer) at $201,534,000. The addition of this sum to the present cost of street lighting would enable the raising of the standard of street lighting at least four times."

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Wisconsin Order Reverses Petition of Utility

A temporary order to reduce the rates of the Wisconsin Telephone Company by 12½ per cent, following that organization's petition for a 25 per cent increase in Madison, Wis., has been made by the Public Service Commission of Wisconsin. Savings of $1,550,000 to 300,000 subscribers are estimated during the coming year.

In the order directing the 12½ per cent reduction the commission said, in part:

"Our investigation, though incomplete, thus far shows clearly that even on the present record existing rates are unreasonable and excessive.

"Since 1929 the dollar has increased markedly in purchasing power. A dollar today will buy 49.9 per cent more in wholesale markets than it would in 1929, 53.1 per cent more in retail food markets, 33.5 per cent more when tested by a very large number of commodities.

"In other words, when a subscriber pays $5 a month to the Wisconsin Telephone Company in April, 1932, he is paying very substantially more than he paid for the same services in 1928, let us say, when the rate may have been fixed by the commission as a reasonable one. In wholesale markets of today that $5 is now worth $7.50.

"A business enterprise enjoying a complete monopoly, not harassed by competition, rendering a service which has become an absolute necessity of business and social intercourse, surely has no statutory or constitutional right to a return in this time of general business catastrophe such as it enjoyed when the community from which it derives its revenue was operating successfully."

Oil Fire Damages New Bremo Station

Fire involving an oil tank adjacent to one of the 15,000-kw. turbo-generators in the new Bremo Bluff station of the Virginia Public Service Company late on June 28 wrecked one end of the plant, causing considerable damage, which is covered by insurance. The beautifully tiled interior of one end of the building was ruined, other building damage occurred, some auxiliary motors were burned, the crane was damaged, considerable control cable and cable feeding auxiliaries was injured, and the Westinghouse main unit was injured, but the extent of this damage is not yet determined, as internal injury may have occurred. The switchboard, buses, circuit breakers, main control and substation escaped injury. There was a minor interruption to service, which was quickly restored. Until the extent of damage to the turbo-generator is determined, it is impossible to know how long it will be out of service. If the turbine is seriously damaged internally damages may exceed $500,000.

The fire was apparently caused by leakage of an oil pipe on a 750 deg. steam pipe, the flames from which spread to the oil tank previously mentioned and burned furiously for about one hour.

This $4,000,000 plant was completed last year as a base-load station and has been furnishing power to interconnecting lines throughout northern Virginia and as far west as Hinton, W. Va. The plant is considered one of the most advanced designs in steam station practice.

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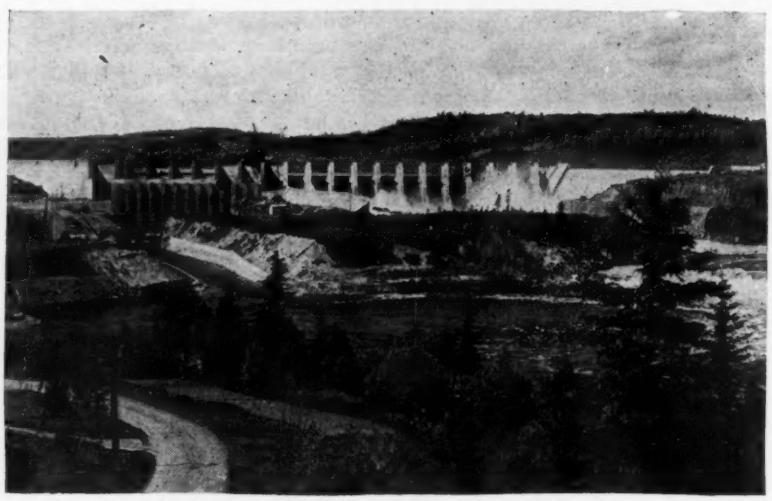
CHUTE-A-CARON DEVELOPS 260,000 HP.



Comprising one of the largest hydro-electric stations in Canada, the station of the Alcoa Power Company, Ltd., at Chute-à-Caron, on the Saguenay River, Quebec, now provides electricity for the reduction of aluminum ores. The installation has a total capacity of 260,000 hp. in four 65,000-hp. units. The plant is the initial step in the Shipshaw development, which is to have an installation of 800,000 hp. under a head of 210 ft.

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Co-operation and Fair Play Asked by Lilienthal

"No rational man will favor any policy with respect to utility rates which will either seriously impair the service or precipitate financial ruin and the destruction of credit of the utility business, or bring with it widespread receiverships and insolvencies of utilities and the savings banks and insurance companies which are heavy investors in their securities," Commissioner David E. Lilienthal told the League of Wisconsin Municipalities last week. He continued:

"If any one supposes that the disparity between the general decline in prices and the failure of utility rates to decline is not comprehended by the average man he should take a look at the files of the Public Service Commission. In the past six or eight months we have been literally flooded with hundreds, even thousands, of letters and formal complaints signed by thousands of consumers. I know of no other time when there has been such a lively interest in the subject of utility rates over the same interval.

The depression has had an important effect upon utilities. This was not true at first. The volume of business of utilities was not affected materially for many months after the crash in the fall of 1929. In the past few months, however, their volume of business has suffered a substantial decline. The utility business is unable to cut costs as rapidly or to the

same degree as many other lines of business. The chief reason for this is that its investment per dollar of revenue is proportionately so large.

I mention these few facts concerning the utility's problem because I want you to know that not only is the situation a difficult one from the consumer's side, but it is far from simple on the utility's side.

Regulation has never in its history been faced with so critical a test as that which it faces at this hour. Utility regulation cannot succeed and our efforts at this hour are doomed to failure unless every one concerned is willing to put his shoulder to the wheel and work the problem out with the commission. It is absolutely essential that two conditions prevail. The managers of utility plants, both privately and publicly owned, must work with us and not against us. They must give us the benefit of their honest judgment. They must accept and act on the principle that the public interest, the general public welfare must be paramount to every other consideration whatsoever, however important.

Business Marks Time with Uncertainty

NOW that the pre-tax flurry, for that is all that it was, has died down business has slumped once more into resigned apathy. Automobile production, which for eleven consecutive weeks has been struggling upward, relapsed upon reaching 55.3 per cent of a 1927-29 normal and dropped to 54 per cent for the week ended July 2.

Car loadings, unable to hold the gain of the week before, sank to 48.8 for the week ended June 25, or close indeed to the record low of two weeks previous. Steel production has fallen once more. Energy output shows slight increase. Security markets are notably feeble, though strength in the period of presidential elections is traditional and consistently supported by figures for many years.

Outlook for the next two months involves few bright spots, but courage, confidence and action may change the picture quickly. England periodically shows us examples of what a nation deeper in the mire than we are can do with every prospect of an eventual recovery.

Federal Trade Commission Halts Utility Hearings

UPON completion last week of its hearings as to the corporate policies of holding companies of the Associated Gas & Electric system, the Federal Trade Commission concluded its public utility hearings for the summer. First on the calendar for examinations in the fall will be the subsidiary operations of this system.

At the final session for the season Charles Nodder, commission examiner, testified that a source of "income" aggregating nearly $3,000,000 over a period of four years was created by the Associated Gas & Electric Company through a method of allocating federal income taxes among its subsidiaries.

The item in the income accounts headed "federal income tax accrued by subsidiaries" represents, Mr. Nodder said, the amount of federal income taxes accrued "as an income deduction by subsidiary companies and credited by them, not to a tax accrual or liability account as is the usual accounting practice, but to the open account of their holding company."

It is the practice throughout the entire Associated system, the examiner explained further, for each subsidiary company to make an accrual of Federal income tax in this manner. These accruals are taken up as income by their subholding company which calculates the tax due, on a consolidated basis, for the group of which it is the parent company, charges the same to its Federal income tax expense account and credits the amount thereof to the account of their holding company."

The holding company in like manner, he continued, includes the amount of its subsidiary company's accruals as income and computes a tax, on a consolidated basis, of the group of which it is the parent, making the same procedure as already outlined. This method is continued through the various groups and subholding companies until the Associated Gas & Electric Company is reached, he said.

In this way, the examiner declared, an amount of "income" is carried through to the Associated Gas & Electric Company (the main "parent" company of the group so far as this method of accruals is concerned), which represents the accruals of Federal income tax of the groups controlled, over a period of years, by certain of the subholding companies.

The examiner pointed out that a consolidated income tax return is filed for the system in the name of Associated Gas & Electric Properties.

The final result of the "highly interesting procedure," the examiner testified, has been to create a source of "income" which in the years 1926, 1927, 1928 and 1929 has aggregated $2,938,513.

The "significant feature" of the procedure used, Mr. Nodder asserted, is that the records of Associated Gas & Electric Company "do not indicate that any federal income tax had been paid during the years shown." Associated Gas & Electric has accrued during these four years, he said, $240,000 per annum as a federal income tax deduction from income, "but an analysis of the reserve created by these annual accruals indicates that no taxes have been paid for the years 1926, 1927, 1928 and 1929, prior to December 31, 1929."

"This method of tax accruals is one which creates a source of income," Mr. Nodder testified, "for Associated Gas & Electric Company at the expense of the several operating subsidiary companies of the Associated Gas & Electric system, for in the final analysis it is such companies that are the source of real income within the system. Furthermore, the item of income taxes is such as to enter —in many states—into the expenses of operating companies to be provided for by rates charged the public.

"In this manner, therefore, the ratepayer, through his monthly bills, donates to the parent organization, ostensibly as operating expenses of the operating company, an amount which the United States government may never receive."

At an earlier hearing last week Mr. Nodder testified that a large part of the long-term obligations issued by the Associated Gas & Electric Company since its organization had no security behind them except the "general credit of the company." The examiner, in summarizing the long-term debt of the company from July, 1909, to the close of 1929, asserted that only the long-term securities issued in the earlier years of the company's history were secured by collateral, which was generally in the nature of stocks and bonds of subsidiary companies.

"Subsequent to 1924, however, none of the obligations has been secured in the sense that specific collateral either in the form of a mortgage on certain property or the deposit of securities has been placed with a trustee, but the holders thereof look to the general credit of the company for payment of principal and interest."

Flathead Project Delay Asked

At a hearing in Washington recently D. M. Kelly, representing the Rocky Mountain Power Company, appeared before the Federal Power Commission requesting, as on April 7 (ELECTRICAL WORLD, March 26, page 562) that the completion of the project should be deferred from 1934 to 1935. Mr. Kelly stated that two plants of the company have been closed and that sufficient power is being developed to meet all needs. To compel completion at this time, it was asserted, will require the spending of millions of dollars. The Office of Indian Affairs questions the right of the commission to permit extension of time without approval of Secretary of the Interior Wilbur.

Coming Meetings

New England Division, N.E.L.A.—Mount Washington Hotel, Bretton Woods, N. H., July 11-13. Miss O. A. Bursiel, 20 Providence St., Boston.

Camp Co-operation XII — By boat to Bermuda, Aug. 3-8. Society for Electrical Development, 420 Lexington Ave., New York.

Wisconsin Utilities Association — Commercial section, Eau Claire, Wisc., Aug. 25-26. John N. Cadby, 135 W. Wells St., Milwaukee, Wisc.

American Institute of Electrical Engineers—Pacific Coast convention, Vancouver, B. C., Aug. 30-Sept. 2. Middle Eastern District Meeting, Baltimore, Md. Oct. 10-13. H. M. Henline, 33 West 39th St., New York.

Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 7-9. H. A. Buch, Telegraph Bldg., Harrisburg.

Rocky Mountain Division, N.E.L.A.—Stanley Hotel, Estes Park, Colo., Sept. 12-14. G. E. Lewis, 367 Gas & Electric Bldg., Denver.

Empire State Gas & Electric Association—Saranac Inn, N. Y., Sept. 22 and 23. C. H. B. Chapin, Grand Central Terminal, New York.

Illuminating Engineering Society—New Ocean House, Swampscott, Mass., Sept. 26-30. E. H. Hobbie, 29 W. 39th St., New York.

National Electrical Wholesalers Association—Hotel Statler, Buffalo, N. Y., Sept. 26-30. E. Donald Tolles, 165 Broadway, New York.

National Safety Council—Washington, D. C., Oct. 3-7. W. H. Cameron, 20 N. Wacker Drive, Chicago.

Great Lakes Division, N.E.L.A.—French Lick Springs, Ind., Oct. 6-8. T. C. Polk, 20 N. Wacker Drive, Chicago.

Association of Electragists, International—Kansas City, Mo., Oct. 10-12. L W. Davis, 420 Lexington Ave., New York.

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Doherty Sues the "Star" for $42,000,000

Two suits asking damages aggregating $42,000,000 were filed on Wednesday against the Kansas City *Star* and its executives by Henry L. Doherty personally and by the Cities Service Gas Company.

The suit of the Cities Service company, alleging conspiracy, seeks $20,000,000 actual and $10,000,000 punitive damages. Mr. Doherty's libel suit asks $6,000,000 actual and $6,000,000 punitive damages.

These actions bring to $54,000,000 the total for which the *Star* has been sued by Henry L. Doherty and the Cities Service company for alleged libel and conspiracy. The first action for $12,000,000 was filed a year ago.

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Energy Tax Rulings May Be Revised by Bureau

Revision of the administration rulings for the new tax on electricity use, especially in so far as it applies to the sales of municipally owned plants, may be forthcoming. The Bureau of Internal Revenue is said to have made the following information available:

Definite enforcement practices for the new electricity tax are still being considered in the light of objections and problems already raised. Conferences between internal revenue officials, representatives of power companies and delegates from cities manufacturing their own power are being held.

One of the problems causing gravest concern is the question of imposing the tax on electricity produced in municipally owned plants and sold for domestic and commercial use. The bureau has ruled that such power is taxable at the rate of 3 per cent, just as is electricity produced by private companies and sold for the same uses, but information has reached the bureau that leagues of municipalities, especially on the Pacific Coast, are considering injunction proceedings to prevent the levy of the tax on energy from city-owned plants.

Should the municipalities secure exemptions, it is considered possible that privately owned utility companies might claim the tax to have become discriminatory and seek avoidance of it on such grounds.

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Pennsylvania Commissioner Faces Pinchot Attack

Climax to the differences of opinion between Pennsylvania's Governor and the chairman of that state's Public Service Commission arrived last week as Governor Pinchot made public a sworn statement by a former employee of the late Thomas E. Mitten of Philadelphia Rapid Transit and called upon Chairman W. D. B. Ainey to attend a public hearing on July 11 to defend himself against serious charges.

A. A. Chapman, former secretary to Mr. Mitten, accused Mr. Ainey of receiving upward of $150,000 from Mr. Mitten over a six-year period, specifically receiving a sum in one instance at a time when a Philadelphia Rapid Transit Company increase from 5 cents to 7½ cents was under consideration.

Mr. Ainey has "specifically and categorically" denied the allegations, stating that, "while I had not always agreed with the Governor, I had sufficient confidence in him to believe that he would not countenance or truckle to any blackmailing attempts."

The Governor has announced that he would send a copy of the charges to the state Senate, which convened this week.

Four agents of the Internal Revenue Bureau, acting on orders from acting Collector William E. Brown, are investigating the bank accounts, financial dealings and income tax returns of Mr. Ainey, who has accepted Governor Pinchot's invitation to present his defense at a public hearing.

"I have been annoyed by Chapman for more than six months and am glad of having this opportunity of meeting you to answer these charges. I will leave no doubt in your mind or in the mind of the public as to the correctness and honesty of my position in this matter," said Mr. Ainey.

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International Practices Discussed by A.S.M.E.

Engineering trends and practices as simultaneously developing and followed in Canada, Great Britain and the United States were discussed at the semi-annual meeting of the American Society of Mechanical Engineers held at Lake of Bays, Ontario, last week. Three sessions were devoted to steam and hydraulic power.

British practice in steam turbine design, advancing rapidly toward the use of both higher temperatures and pressures, was reviewed by F. W. Gardner of England, while a paper by Vern E. Alden and W. H. Balcke of Stone & Webster covered contemporary thinking in this country as manifested in variations, some frankly experimental.

In hydraulic practice the developments of Canada and Europe were covered respectively by T. H. Hogg and R. W. Angus, both of Canada. The economic balance between steam and hydro capacity was the topic of a paper prepared by K. M. Irwin, United Gas Improvement Company, and Joel D. Justin.

"It has been made plain to us by the depression," said James D. Mooney of General Motors, in speaking at the management session, "that we are good production managers, but that we have not succeeded too well as administrators of industry. Administration must face its responsibilities of acquiring a better understanding and knowledge of economic laws and of adjusting its various industrial efforts to the inevitable operation of these laws. Accept the challenge of developing a philosophy of fitting your respective operations more accurately into the present economic, social and political environment — a philosophy that will enable you better to discharge your over-all responsibilities to stockholders, employees and clients."

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2,770 Miles of the Grid Completed in Britain

According to a statement just issued by the Central Electricity Board, the construction of Britain's national transmission system had, at the end of May, reached a point where, of about 4,000 miles required for overhead lines, right-of-ways for 3,725 miles had been obtained. For primary lines alone, operating at 132,000 volts, only 84 miles re-

Current Earnings Reports of Electric Light and Power Companies

OPERATING COMPANIES

	1932	1931	Per Cent Increase	Operating Ratio 1932	Operating Ratio 1931
Detroit Edison (Year ended May 31)					
Gross earnings	$47 090,246	$51,502,019	— 8.6	67	67
Net earnings	15,573,319	17,089,609	— 8.9	..	..
Net profit	9,524,838	11,103,265	—14.1	..	..
Kansas City Power & Light (Year ended April 30)					
Gross earnings	14,664,927	14,814,076	— 1.0	45	47
Net earnings	6,013,970	5,723,191	5.1	..	..
Net profit	4,213,512	3,940,000	6.9	..	..
Pennsylvania Electric (Year ended March 31)					
Gross earnings	8,163,814	8,416,749	— 3.0	66	60
Net earnings	2,758,413	3,369,228	—18.2	..	..
Net profit	1,453,471	1,107,869	3.1	..	..
Public Service of New Jersey (Year ended April 30)					
Gross earnings	134,230,001	139,209,798	— 3.6	67	68
Net earnings	45,030,651	44,703,253	0.7	..	..
Net profit	21,194,741	22,714,864	— 6.7	..	..
Southern California Edison (Year ended April 30)					
Gross earnings	39,749,099	41,420,357	— 4.0	32	31
Net earnings	26,990,197	28,369,394	— 5.0	..	..
Net profit	12,924,544	14,326,315	— 9.8	..	..

HOLDING COMPANIES

	1932	1931	Per Cent Increase	Operating Ratio 1932	Operating Ratio 1931
American Water Works & Electric & subs. (Year ended April 30)					
Gross earnings	48,092,830	52,839,076	— 9.0	56	59
Net earnings	21,205,941	21,836,652	— 2.9	..	..
Net profit	4,370,217	4,916,894	—11.1	..	..
Columbia Gas & Electric & subs. (Year ended March 31)					
Gross earnings	85,281,168	94,299,791	— 9.6	67	67
Net earnings	27,766,831	31,202,694	—11.0	..	..
Net profit	13,999,918	18,618,596	—24.8	..	..
Commonwealth & Southern & subs. (Year ended April 30)					
Gross earnings	125,941,372	137,444,281	— 8.4	54	55
Net earnings	58,904,325	61,718,418	— 4.5	..	..
Net profit	11,297,868	18,010,513	—37.3	..	..
North American Light & Power & subs. (Year ended March31)					
Gross earnings	45,634,192	47,054,505	— 3.0	61	61
Net earnings	17,653,045	18,342,913	— 3.8	..	..
Net profit	2,362,073	4,235,741	—44.1	..	..
United Gas Improvement & subs. (Year ended March 31)					
Gross earnings	105,031,034	108,114,010	— 2.8	56	57
Net earnings	45,819,236	46,135,961	— 0.7	..	.
Net profit	28,259,927	28,964,912	— 2.4	..	..

Gross earnings — Gross operating revenue. Net earnings — Earnings after deduction from gross earnings of operating expenses taken to include taxes, depreciation, maintenance, operating, etc., where available. Net profit — Balance available from income for common-stock dividends.

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mained to be negotiated out of a total of 2,876 miles; 2,770 miles have been constructed and, in central Scotland, northeast England, mid-east England, central England and east England the transmission system is practically complete.

About 1,250 miles, including cables, is in operation, principally in southeast England, central Scotland, mid-east England, central England and northwest England. Satisfactory progress has been made in the standardization of frequency in central Scotland, northeast England and central England.

The total value of contracts placed and expenditure approved by the board is now over $157,500,000. This, it is said, has been exceedingly helpful to employment in the electrical and allied industries.

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Abitibi Deal Under Discussion

Either the Ontario government or the Ontario Hydro-Electric system will take over, on terms to be negotiated, the power development project of the Ontario Power Service Corporation at Abitibi Canyon, northern Ontario, according to an announcement by Premier Henry of Ontario. Financial difficulties of the corporation lie behind the government's proposed action. The corporation has been faced with the necessity of raising $5,000,000 to complete the Abitibi Canyon power project. Five weeks of negotiation between government and company officials culminated with Premier Henry's statement. Failure to raise the necessary $5,000,000 would have forced the corporation to shut down its work, throwing 1,000 men out of employment and depriving northern Ontario of a new source of electric power.

An important stage in the Abitibi development was reached on June 13, when the dam received a water test for the first time since its construction began in April last year. The site of the new dam, which will provide a head of about 237 ft., is on the lower Abitibi River, north of Cochrane, Ont., and the plant has been designed for five units of 66,000 hp., or a total of 330,000 hp.

The Ontario Power Service Corporation is a subsidiary of the Abitibi Power & Paper Company, Ltd., which failed to meet the interest due June 1 on its first mortgage 5 per cent bonds, series A. As a result, protective committees were formed and requested deposit of the bonds and preferred stocks of the company.

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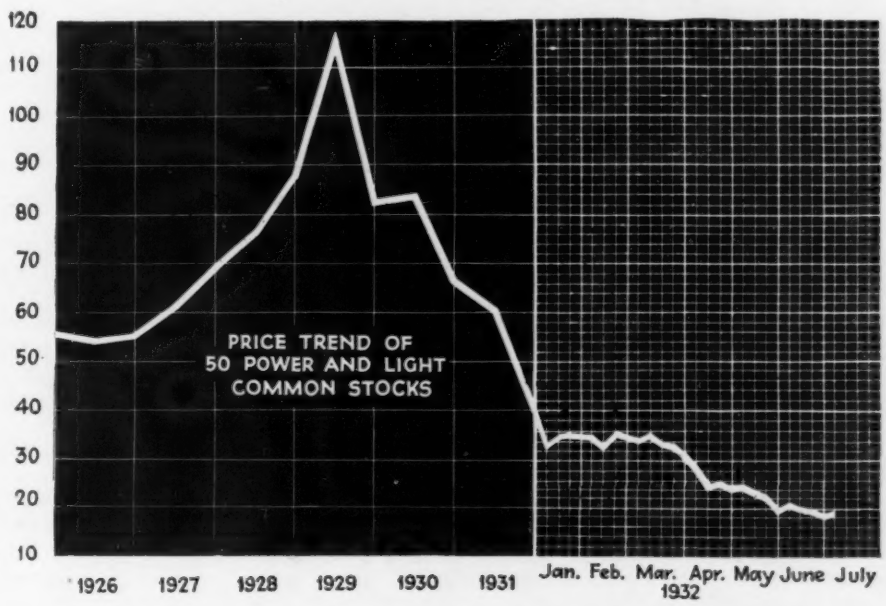
Utility Stock Market Dull



Utility stocks are showing no strength in the way of recovering the ground lost during the month of June. The "Electrical World" index advanced only fractionally from 18.5 last week to 18.8.

Trumbull Sees N.E.M.A. Plan as New Guide for Industry

CHARACTERIZING "the N.E.M.A. Mutual Unemployment Benefit Plan," as the Swope proposal sanctioned by the National Electrical Manufacturers' Association is now officially designated, as the answer of both employees and employers to those who are pressing for "more government," President Trumbull has pointed out that any sound theory of unemployment benefits must regard the worker as "the forthright master of his own destiny rather than as the ward of the state."

The electrical industry, Mr. Trumbull states, has found in the N.E.M.A. plan, which provides for emergency as well as for normal conditions, a successful method of protecting its 200,000 workers and of meeting the tests of depression.

"Companies which have installed or are considering the plan," he reported, "are finding that the provisions they have made to meet the current situation lie within the proposals of this 'emergency condition' and that their operations are clarified and made more effective by adopting its requirements. In other words, the plan is directly applicable to the immediate situation and its operation presents advantages which those who undertake a study of it are quick to realize.

"Two fundamental forces are at work during the economic recession," Mr. Trumbull asserted. "One veers toward more government; the other toward less. The first would shift the burdens of society to the federal political power with, perhaps, too little regard for its limitations. The second would adhere to the doctrine of individual self-reliance.

"This plan, now known as 'the N.E.M.A. Plan,' excludes the idea of surrender. It does not look to government to exercise those functions which collectively employer and employee should exercise, or to borrow those virtues of constructive endeavor with which by some it is falsely believed to be clothed."

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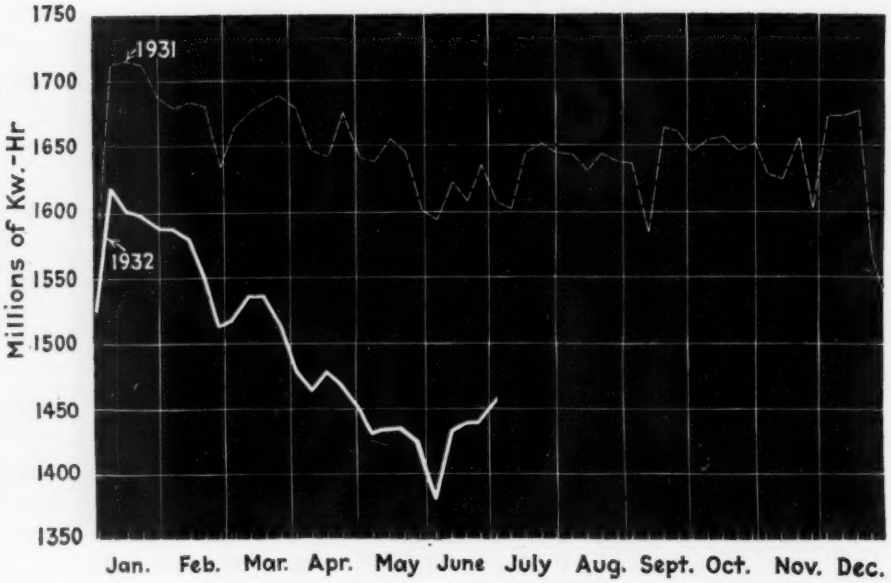
Output Again Increases



ELECTRICAL energy output by central stations for the week ended July 2 is estimated by the National Electric Light Association at 1,456,961,000 kw.-hr., or well in excess of the 1,440,541,000 kw.-hr. of the preceding week. While comparison with 1931 shows a closer approach to that year's operations than in other recent weeks, the effect of the holiday in the corresponding week of 1931 must be taken into consideration.

Much more significant is the definite upward trend throughout May and June, now accentuated, interrupted only in the week of Memorial Day, whereas a moderate decline would have been normal at this season.

For the reason previously stated it seems best also to omit the usual comparisons by geographical regions. Instead, the average changes for the fortnight containing the holiday in both years will be published next week.

Weekly Output, Millions of Kw.-Hr.

Week Ended	1932	1931	1930	1929
July 2	1,457	1,607	1,594	1,592
June 25	1,441	1,635	1,704	1,723
June 18	1,442	1,610	1,698	1,703
June 11	1,435	1,621	1,707	1,699
June 4	1,381	1,594	1,657	1,690

Per Cent Change from 1931

Region	Week Ended July 2	June 25	June 18
Atlantic Seaboard	.....	— 9.5	— 6.3
New England alone	.....	—10.8	— 9.5
Central industrial	.....	—14.2	—12.7
Pacific Coast	.....	— 9.6	— 7.6
United States	.....	—11.9	—10.5

Classified Off-Peak Rate Encourages Water Pumping

To enable municipal water pumping to be handled economically from the dual viewpoint of the customer and the utility the Blackstone Valley Gas & Electric Company, Pawtucket, R. I., is about to put in effect a classified off-peak rate which applies to such loads of 500 kva. or over, service being supplied direct from the company's primary distribution lines and energy metered on the primary side of the transformers.

Service periods are defined as evening peak, day hours and night hours, the rate per kilowatt-hour in Pawtucket being 3 cents on the evening peak, 1.2 cents in day hours and 0.75 cent in night hours. The evening peak period is defined as from 3:45 p.m. to 5:45 p.m. on Mondays to Fridays inclusive from October 1 to February 28 (or 29) inclusive. Day hours run from 6:45 a.m. to 3:45 p.m. on the above days and from 6:45 to 5:45 p.m. on Mondays through Fridays from March to September inclusive.

The new rate does not restrict the city from pumping electrically at any time it so desires, and the maximum rate applies to but two hours per day through the middle fall and winter seasons, excluding Saturdays and Sundays even then. The day rate applies for nine hours per day every Monday to Friday inclusive through the mid-fall and winter and eleven hours per day on the first five days of each week in the March-September period. The medium price quoted enables the city to do a liberal amount of its electric pumping by day if it so desires. The night hour rate, which covers all other hours in the year, including 24 hours on Saturdays, Sundays and holidays, offers the city a strong inducement to adjust as much of its pumping as possible to these periods, likewise giving the company an opportunity to market secondary steam plant energy available at times of low system load and to utilize interconnected power.

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Allis-Chalmers Omits Dividend

Directors of the Allis-Chalmers Manufacturing Company voted on July 1 to omit the quarterly dividend usually payable about August 15 on the common.

What Would Families Like to Buy Next?

An electric refrigerator, if one accepts the results of a recent survey reported upon by Daniel Starch at the Public Utilities Advertising Association convention in New York, is the most eagerly anticipated future purchase by 1,057 families in 21 cities and fourteen states.

In all, 37 different items were mentioned as the things the families wanted to buy next. Out of these, twelve, or practically one-third, were gas or electric appliances for the home. Of the first five, four were electricity-using appliances.

Here is the first fifteen choices of things wanted lined up with the percentage of families naming each for first selection: Electric refrigerator, 28.0; rug, 14.8; radio, 12.1; washing machine, 10.1; vacuum cleaner, 9.8; "furniture," 9.1; living room furniture, 7.1; bedroom furniture, 5.7; automobile, 5.5; curtains, 5.2; stove or range, 5.2; electric clock, 5.0; dining room furniture, 4.9; lamp, 4.2; "electric appliances," 3.8.

"That they want electrical appliances is obvious from the above figures," Mr. Starch pointed out. "Now, how to make them buy is our job. Advertising the convenience of an electric refrigerator, for instance, would not seem to be the strongest appeal at the present time. With 28 per cent of the people already wanting this convenience it would seem that they must be approached from another angle. I venture to say that had we asked these same people why they did not have an electric refrigerator their answer would have been, 'we can't afford it.' Why not more copy stressing the fact that an automatic refrigerator is not a costly luxury which is far out of their reach? Can we not educate them to the point where they realize that it is an actual economy in the long run? Tell them that it will cost no more than less satisfactory methods of refrigeration. More could be done if electric refrigerator manufacturers would stress this appeal to a greater extent rather than the particular advantages of their own machine."

Mr. Starch also contended that it was largely through advertising that sales and relationship problems must be presented for solution.

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Railroad Car Air Conditioning Becomes Semi-Utility Load

Advances in air-conditioning equipment as used on American railroads for increasing passenger comfort are proceeding rapidly. Most recent contributions by Westinghouse engineers involve a high-speed motor-compressor unit which receives energy from a geared-drive axle generator, twice as powerful as the familiar belt-driven generator.

By an unusual arrangement cars may be cooled in the yard before a run by merely plugging the system into an existing alternating-current power supply. While this is taking place batteries may be charged without change in connections. When the cooled train is ready to start out the service can be switched over to the direct-current power supply carried on the cars. This installation is on Illinois Central Railroad cars.

Major New Construction This Week

HYDRO-ELECTRIC power development to cost $300,000 planned by A. W. Johnson, Oroville, Wash., on Similkameen River, where site has been secured. Dam will be 125 ft. long and 38 ft. high; project includes transmission line.

Machine drives, motors, controls, conveyors, etc., will be installed in $70,000 addition to canning plant, Indian River Fruit Products, Inc., Titusville, Fla.

Bids will soon be asked for equipment for a power plant for pumping station service at city water works by Department of Public Works, St. Paul, Minn. Estimated cost $75,000.

Electric power plant equipment, motors and controls, distributing systems, etc., will be installed in group of new buildings, including power plant, to be constructed by Dillard Memorial University, New Orleans, La. Cost over $250,000.

Electric generator, boilers, transformers, etc., will be asked for in bids for city-owned power plant at Ralston, Neb. Estimated cost $96,000.

Motors, controls, automatic equipment and conveyors needed for new multi-story peanut butter plant of Wilmar Manufacturing Company, Philadelphia, Pa. Estimated cost $100,000.

Heavy-duty motors and controls, elevating and conveying equipment, etc., will be installed at breaker of Harris-Denly Coal Company, Exeter, Pa., to replace unit recently destroyed by fire. Cost $50,000.

Early call for bids is scheduled for complete equipment for city-owned electric power plant at Paris, Ky. A $150,000 project.

British General Electric Earnings Steady

Preliminary figures of the results of the General Electric Company of England, just issued, show that this undertaking has been able practically to maintain its profits, despite very difficult conditions in both foreign and domestic markets. Earnings for the year ended March 31 last amounted to £1,057,657 ($5,288,285), compared with £1,122,007 ($5,610,035). The dividend on the ordinary shares, however, is reduced from 10 per cent to 8 per cent for the year.

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New York Metal Prices

	June 30, 1932 Cents per Pound	July 6, 1932 Cents per Pound
Copper, electrolytic	5.33	5.375
Lead, Am. S. & R. price	2.95	2.75–2.85
Antimony	5.00	5.00
Nickel, ingot	35.00	35.00
Zinc, spots	3.05	2.95
Tin, Straits	19.60	20.875
Aluminum, 99 per cent.	23.30	23.30

International Congress Opens

Greeted by President Lebrun of France, delegates to the Fifth International Electrical Congress met on Tuesday of this week at the Sorbonne, Paris, France, for the first session of a discussion scheduled to last for a week. Paul Janet is president of the Congress. The meeting will not touch on commercial subjects, but will be confined to the realm of pure science. Twenty-seven papers by American contributors are scheduled. Harold Pender of the University of Pennsylvania's school of engineering heads the American delegation.

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South Carolina Study Progresses

Such progress has been made in the study and investigation (ELECTRICAL WORLD, March 19, page 514, and April 30, page 762) of the five large electric utility companies in South Carolina that the first report, recommending readjustment of rates, is expected to be filed with the South Carolina Railroad Commission about the middle of July by the electric utilities division of the commission.

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James River Hydro Modernized

The hydro-electric station of the Appalachian Electric Power Company, a subsidiary of American Gas & Electric Company, located on the James River near Lynchburg, Va., has recently been completely modernized. The station now consists of five 3,125-kva. 4,000-volt generators, one 15,000-kva., 4,000 Y/13,200-volt and one 10,000-kva., 13,200/132,000-volt transformer bank, five 13,200-volt, 150/300-amp. feeders and two 132-kv. circuits. This apparatus is controlled by a General Electric miniature switchboard.

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Dixie Power Changes Name

Change in name from Dixie Power Company to Southern Utah Power Company is reported for the utility serving Cedar City, Utah, and vicinity. It is said by R. H. Gardner, general manager of the company, that this was done to aid in the marketing of the securities of the company outside the territory served, as it more accurately describes the service field of the property.

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Milwaukee Utility Cuts Salaries

All wages and salaries paid by the Milwaukee Electric Railway & Light Company will be cut by approximately 10 per cent, according to a statement issued by S. B. Way, president. The company is not earning common-stock dividends under present conditions, but by means of this reduction in salaries it is intended to insure the payment of bond interest and preferred-stock dividends. The railway situation has complicated the status of the company, the electric light and power earnings having helped support the railway service. At the present time these earnings are at a level which leaves no possible contribution toward the support of the railway service.

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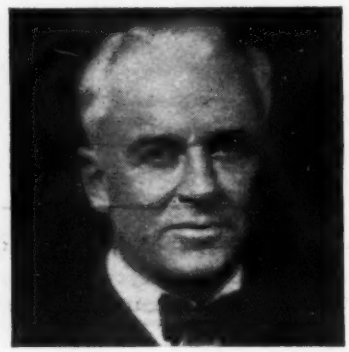

Modern science has shown us how to load a large part of the grinding labor upon the backs of soulless, feelingless machines so that leisure for the higher things now is a possibility for every one. The great job of the coming century is to learn to utilize that leisure.

R. A. MILLIKAN,
Physicist and
chairman of the executive council
California Institute of Technology

[Dr. Millikan spoke at the dedication last week of the Daniel Guggenheim Airship Institute in Akron, Ohio.]

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Annapolis and Chesapeake Auction

In accordance with the order of Federal Judge Coleman of Baltimore (ELECTRICAL WORLD, May 21, page 879) a receiver's sale has been scheduled for July 15 of "all the property, franchises and business, both gas and electric, of the Annapolis & Chesapeake Bay Power Company." The company is being operated by the receiver. In 1931 it reported a gross operating revenue of $932,349. Approximately 11;500 customers are served. Facilities are leased from the Consolidated Gas, Electric Light & Power Company.

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Tacoma Rejects Utility Stay

Efforts of the Tacoma Chamber of Commerce to obtain a year's stay in the contract providing for the withdrawal of the Puget Sound Power & Light Company from the field have failed with the refusal of the City Council to consider such a proposal. Commissioner Ira S. Davisson discounted the need of a competing system since the "city system has been made so complete, with surplus water power and an emergency steam plant, and since the rates are the lowest on the continent."

N.E.L.A. Exhibitors to Get Rebate

So successfully did the exhibition committee of the National Electric Light Association keep the operating expenses in connection with the 1932 exhibition below the income from the sale of space that a rebate of 36 per cent has been authorized for the exhibitors. This action is in accordance with the committee's established practice of returning to the exhibitors the difference between the operating expenses and the income from the sale of space.

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Kelvinator to Make Oil Burners

Production of "Rightway" oil burners by the Kelvinator Corporation will begin immediately and shipments on orders that have been held up for some time are coming through for delivery to dealers this week. Kelvinator operations, as far as electric refrigeration is concerned, have been maintained on a satisfactory basis, shipments to date this year exceeding those of last year for the similar period.

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Columbia River Agreement

By the terms of the bill covering the apportionment of Columbia River waters, signed last week by President Hoover, the States of Washington, Idaho, Oregon and Montana are given until January 1, 1935, to enter into an apportionment. It is provided that Wyoming is to be a party to the agreement.

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226 Kw. for Baseball Lighting

At the new Columbus, Ohio, stadium what is said by General Electric engineers to be the best-lighted athletic field in America has been established. Here 94 projectors accommodating 1,000-watt lamps and 88 open floodlights using 1,500-watt lamps have been installed. All lamps are operated at 10 per cent overvoltage. Mounting heights of 90 to 105 ft. are used.

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Insull Companies, Investment Funds to Liquidate

Plans have been adopted for liquidation of the Commonwealth Edison Company and the Public Service Company of Northern Illinois employees' investment funds and for repayment of subscriptions over a period of ten years ending June 15, 1942, with interest accumulating on unpaid balances. These trusts were voluntary associations of employees formed for investing in Insull stocks. They are in no way connected with employee mutual benefit associations, of which solvent and strong organizations exist in both companies.

2,200-Kw. Electric Boiler for Lumber Processing

Needing steam for use in its dry kilns, the Red River Lumber Company has found it economically advantageous to utilize the excess power available at its hydro-electric plant to generate steam electrically rather than by burning oil in its steam plant.

Ordinarily the supply of hogged fuel obtained as a by-product of lumbering operations is sufficient to produce the steam requirements, but curtailed production forced a new plan. It is said that the savings in fuel oil and plant maintenance costs more than justify the expenditures made for the electric-steam boiler.

The boiler, which is rated at 2,200 kw., is of the three-phase, 60-cycle type and generates steam at 165 lb. gage.

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Channel Buses Improve Vertical Distribution

By using aluminum channel buses instead of cable risers for vertical distribution in the low-tension network of the 44-story Field Building in Chicago a number of advantages have been realized. Decision to use channel buses followed an exhaustive study of previously adopted measures for similar service.

Lightweight, rigid channel buses have permitted single support points at centers of risers and comparatively long intervals between spacing points. All six risers in the building are made with one conductor per phase. Maximum distance to the end of any riser from its point of support is not more than 135 ft. In order to minimize splices channel lengths of 60 ft. or more were used. Spacing bars are placed at intervals of about 11 ft. Special provisions for heat diffusion were made.

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Absolute Measurement of High Potentials

Difficulties in securing comparable measurements of high voltages now in common use are said to have been overcome in a procedure developed by W. M. Thornton and W. G. Thompson and recently described before the Institution of Electrical Engineers (England).

The improved method involves observations of the polarization of a metallic ellipsoid of revolution suspended by an insulating fiber between vertical circular pole plates. The dimensions and proportions of the ellipsoid and of the horizontal field are determined with high accuracy and the magnitude of the electric gradient on the axis of symmetry of the instrument calculated for given applied voltages. Readings are obtained by calculations based upon a constant determined by the dimensions and a comparison of the number of swings per second of the ellipsoid with the field on and off. According to the paper presented by the authors continuous measurements of voltages up to 200 kv. can be made to an accuracy of at least three parts in 1,000.

Load Dispatcher Dials Indicator Board Changes

Control and selective devices that characterize modern telephone art are being rapidly adapted to the peculiar problems of power system supervision and operation. This adaptation is strikingly apparent in modern boards for reproducing system conditions in the dispatching offices of large systems. A number of these modern boards have already been installed and the largest and most up to date of them is said to be in the load dispatcher's office of the Union Gas & Electric Company, Cincinnati, Ohio.

Some features of this board made possible by the use of automatic telephone equipment are that the mechanical indicators on the board are electrically operated from the system operator's desk by means of an ordinary telephone dial and that the board and its equipment are designed for future use with supervisory control and remote indications without radical revision of the equipment and circuits now existing on the board. Another feature of the board is that it is of the unit type, permitting its enlargement and rearrangement to reflect changed system conditions with the minimum of labor and cost. The board incorporates a mimic power scheme which is easily and conveniently operated by the load dispatcher immediately after system changes have been reported to him. It is thus very easy to keep on the board at all times a faithful reproduction of system conditions.

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TAKING THE TERROR OUT OF KIRCHOFF'S LAW

Studies of power flow, regulation, losses, power factor and system stability are made quickly and easily on this alternating-current calculating board recently installed in the engineering department of the Commonwealth Edison Company, Chicago. Built by the Westinghouse Electric & Manufacturing Company, it is said to be the first alternating-current calculating board to be placed in regular use by an operating utility. It operates on a frequency of 440 cycles. On it can be reproduced in terms of circuit constants the whole or any part of the Commonwealth Edison a.c. system.

EDITORIALS

L.W.W.MORROW
Editor

Relief legislation in balance

THE Wagner-Garner relief bill may yet become law and mark the final legislative enactment to aid industry. As stated by Senator Wagner, this bill embodies extraordinary remedies and provisions that would be unthinkable in normal times.

One of these provisions is that the Reconstruction Finance Corporation should be permitted to make loans to private industries and that wherever practicable no one shall be employed more than thirty hours a week upon projects prosecuted under this bill. Astonishing power is given to the President and to the Reconstruction Finance Corporation to spend the $2,100,000,000 appropriated for construction and relief work.

Enterprises in the electrical industry will do well to study the provisions of this bill as it may aid them directly in providing money for business expansion. But beyond this there are major principles of economics that need serious consideration before they are built into a permanent legislative policy whereby government fixes the wages of capital and of labor and prescribes the conditions for capital expenditures and wage payments. Emergency practices may become permanent policies.

An opportunity—ice for air conditioning

THE National Association of Ice Industries has prepared for ice manufacturers and dealers a series of seven manuals explaining the use of ice in air conditioning, showing the potentialities of the market and advising how it may be developed. These manuals are crammed full of significance, and the ice dealer into whose hands they come cannot help being enthusiastic about the business that is waiting for him to go and get it. It is too early yet for this effect to be noticeable, for the manuals are now only a few weeks off the press and their distribution is hardly begun. It is time now for utility men to learn what it is all about so that when the ice men in their communities begin to bubble with enthusiasm over the idea the utility men will go along with them in equal enthusiasm.

There is no reason for any one to infer that electric utility interest in ice for air conditioning means a diminution of interest in other methods. For the utilities warmly to promote ice in this application in those instances in which ice is patently the more economical and therefore the more easily salable method is simply for them to recognize merit where it is apparent. No one can be criticised for that. There still will remain for air conditioning with mechanical refrigeration a field large enough to tax the energy and productive capacity of the compressor industry for a long time to come.

A time for new standards

ACCEPTING the prognostications of the economists, we are in for a long period of slowly rising prices. Profit margins will be small at the outset and competition keen. Price is likely to give quality a stern tussle for dominance in trade transactions. That raises a question about standards and their influence on both quality and cost, if not on price as well. Electrical standards have been built up laboriously during the period when the market could well afford to pay for the privilege of proved performance as insured by standards based on lifetime costs of equipment and upon a certain level of technical attainment.

No one would for a moment advocate the complete jettison of these standards. But there is a

commercial risk in adhering blindly to them when the disposition of the buyer is to ask for discounted price in return for discounted quality and when competing manufacturers take advantage of new materials and new technology to develop substitute apparatus of equal quality but less cost.

But many of the technical standards are more closely allied to dimensional specifications and simplification in manufacture than to quality. Without materially affecting quality there can therefore be a measure of response to the commercial pressure for lower prices. Redesign of equipment will make it possible for some manufacturers to bid for business on a price basis that frankly conforms to a slightly shaded degree of quality or performance. If that be done with all candidness there can be little objection from either buyer or maker who rightly condemns mere price cutting without compensatory adjustments.

When business again becomes stabilized at new cost and technological levels there can be a resumption of the standards that fit the new conditions. In the final analysis standards anyhow are but temporary agreement rungs on the ladder of progress.

Torn bootstraps won't pull anybody out of the mud

IN THE scramble for economy some utility companies are searching their warehouses for discarded material to avoid the necessity of purchasing new. Meters that were taken out of service years ago as obsolete are being dug up and used for new customers. Second-hand dealers are doing the kind of business they have not been able to do for years and are actually selling second-hand transformers to utilities. Manufacturers' engineers are kept busy checking up the records of old equipment from rusty name-plate data and are pressed hard to answer that such pieces of apparatus can be used for different purposes than those for which they were intended.

Even in cases in which the equipment when new would have been satisfactory for the purpose specified, it is too much to ask a manufacturer to commit himself to advice that a chance can be taken with overloading, overrating or rerating. Because the equipment was generally in service for a long time and was taken out of service for a good reason, it is likely that it is not far from breakdown. At the best, obsolete transformers are naturally much less efficient than new transformers and will mean additional burdens on the already overburdened distribution cost. Old meters will cause complaints to public service commissions, with resultant expenses for attending hearings and employing lawyers. Such shortsighted policies will certainly not help the utilities to pull themselves out of the mud.

Cost of free lamp renewals

"FREE" lamp renewals are challenged. Utility companies that furnish lamps to their customers and include lamp costs in rates should watch closely the rehearing in the Illinois Commerce Commission of the complaint of the Consumers Sanitary Coffee and Butter Stores against the Commonwealth Edison Company. The commission denied the complaint in its original hearing. This decision was appealed through the courts until the Supreme Court of the state ordered the case back to the commission, where it will be reheard.

The crux of the case is the assumption of the complaining customer that one-half cent per kilowatt-hour is added to the rate to compensate the utility for lamp service. The commission will probably examine into the actual cost of lamp service in Chicago to determine whether the one-half cent per kilowatt-hour cost referred to in the case is correct or whether some lower cost should be applied. The assumption that one-half cent per kilowatt-hour was the proper cost of lamp service was not categorically contested by the utility in the original hearing. The defense of the Commonwealth Edison Company was that electric lamps furnished by it were not merchandise sold to the customer, but were a necessary part of the lighting service and remained the property of the utility company, and that, therefore, the lamps were an item of cost in the service and should be so included in the rates.

The significance of this case is, as was pointed out in the report of the original hearing, that it is the first, apparently, of its kind. Since the Commonwealth Edison Company has nearly a million customers, and other companies millions more, who may be affected by the precedent if the commission reverses its first decision it is easy to realize its importance to the utility industry.

Gaseous-Discharge Lamps Are Practical Light Sources

By R. D. MAILEY

Vice-President General Electric Vapor Lamp Company, Hoboken, N. J.

So much has been hopefully prophesied as to the future of luminous gas-electric lighting for general purpose use, following the successes in the sign field, that "Electrical World" has asked Mr. Mailey to state tangibly the potentialities and limitations as they can be foreseen and stand today.

THE ideal toward which research and commercial development in the gaseous-discharge-lamp field is tending is the production of a source which will operate steadily on 110 volts alternating or direct current, will not lose its output efficiency either upon warming up or with reasonable age, will light instantly when the switch is closed, will relight if interrupted and without waiting for a cooling-off period, will operate with a lighting frequency of 60 cycles or more, thus avoiding eyestrain from stroboscopic effects which are encountered with half-wave rectification, will be of such design as to incorporate the necessary balancing resistance in the lamp base in small space and which will offer a dependable, attention-free item for reliable lighting equipment.

These are essentially the only requirements to be met. It is not reasonable to expect a high-intensity gaseous discharge source which can be inserted in standard fixtures of the type now used for incandescent-filament lamps. For gaseous-discharge lamps built-in lighting equipment is almost beyond question the necessary thing. To secure white light or virtually white light on work and seeing areas it is possible, but not probable, that a commercially practicable mixed-gas, self-segregating lamp can be developed, but it is more likely that a synthesis of two or three individual color lamps in a single source area must be relied upon to produce the desired approximation.

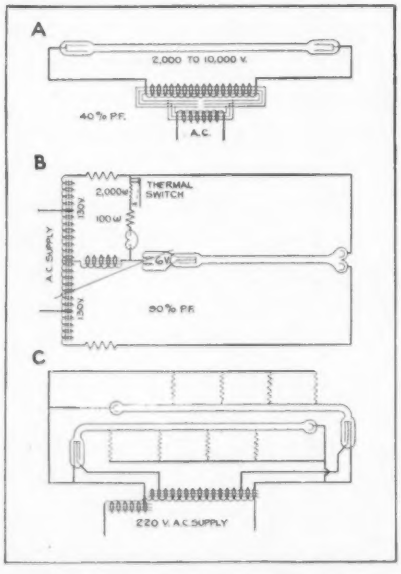


Fig. 1—Arc-ballasting series impedance necessary for all gaseous discharge lamps

(A) Typical sign lamp circuit; (B) standard heated cathode rectifier type circuit; (C) layout for latest type internally heated electrode lamp.

While claims of various sorts have been somewhat glibly made from time to time regarding the supposed virtues and characteristics of recent innovations in the gaseous discharge tube lamp art, it is apparently true that no lamp is today available which incorporates all the desiderata just mentioned. The nearest approach is a lamp which may be made for current ratings of one to twenty or more amperes and which operates at an over-all efficiency of about seventeen lumens per watt. This source may be made for neon, mercury or virtually any of the other rare gases and only fails of matching the ideal in two respects, namely, it operates on half-wave rectification and requires virtually negligible attention at uncertain intervals to maintain operation.

If the desirable feature of 110-volt starting be overlooked and higher potentials be accepted several other types of lamps become available and have indeed been used in pioneering installations. These can and do operate with long life and high over-all efficiency.

Negative resistance characteristics force complicating circuits

All gaseous-conduction lamps require, in addition to the tube which may be compared with an incandescent lamp bulb, an arc-ballasting series impedance which absorbs from one-quarter to one-half of the supply voltage. When largely inductive this impedance produces a power factor which may be as low as 40 per cent, and when largely resistive it results in an energy loss which may reduce the efficiency rating by as much as 30 per cent. This arc ballast or auxiliary is always an essential part of an operating gaseous lamp and its disposal is the main problem in any attempt to approximate the simplicity and the compactness of an incandescent lamp.

An important additional part of this auxiliary, in the case of low-voltage operation, is a gas ionizing or starting device which must sometimes be connected in series with an additional delayed acting switching device.

In Fig. 1A is shown the complete circuit of the alternating-current, high-voltage, cold-electrode, gaseous-conduction lamp generally used for sign-lighting work. In it a high-reactance transformer supplies both the high

voltage and the ballasting of the luminous discharge. In Fig. 1B is the circuit of an alternating-current, low-voltage, internally heated cathode rectifier type arc lamp available in mercury, neon, and other gases. This is essentially the circuit in use for years in the standard Cooper-Hewitt lamp.

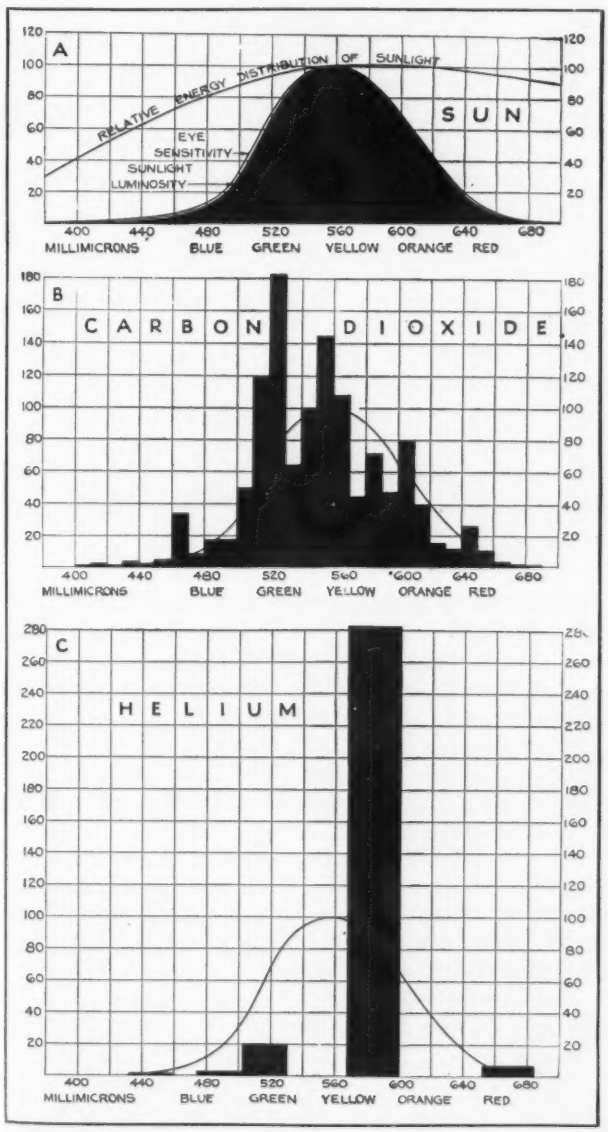
Gases are not normally conductors of electricity and in lamps must be ionized before a discharge can be established. In lamps having an applied voltage of the order of 1,000 this ionization is established directly by the operating high voltage, but in lower voltage lamps an auxiliary source of high voltage must be applied temporarily, as indicated in Fig. 1B. This high voltage is, however, of the transient high-frequency, low-energy sort used in automobile ignition and does not necessitate the high-voltage insulation and safety measures required by high-voltage lamp operation.

In the starting method indicated in Fig. 1B, a current of less than an ampere is shunted through a small evacuated mercury switch in parallel with the inoperative lamp tube and energizes the series ballast inductance, whose magnetic field, in turn, acts upon an armature to open the circuit in the mercury switch. The result is a transient high potential induced on the terminals of the arc and usually sufficient to establish the arc.

Since even relatively low voltages produce some ionization in the immediate region of the electrodes, just as high voltages produce it throughout the whole tube, a lamp has recently been developed with a series of auxiliary electrodes, each connected to sufficient resistance to keep its current down to the few milliamperes necessary to maintain local ionization. In Fig. 1C is the circuit of such an alternating-current, low-voltage, internally heated electrode, half-wave rectifier, probe-starting arc lamp which is already in use in a few commercial installations.

The familiar gaseous-conduction lamps in general use in signs require thousands of volts to start and operate, and for satisfactory efficiency must be made very long. To avoid the hazard of high voltages and the limitations

Fig. 2—Relative energy distribution of sunlight, the eye sensitivity curve, and the luminosity patterns of sunlight and carbon-dioxide light and helium light



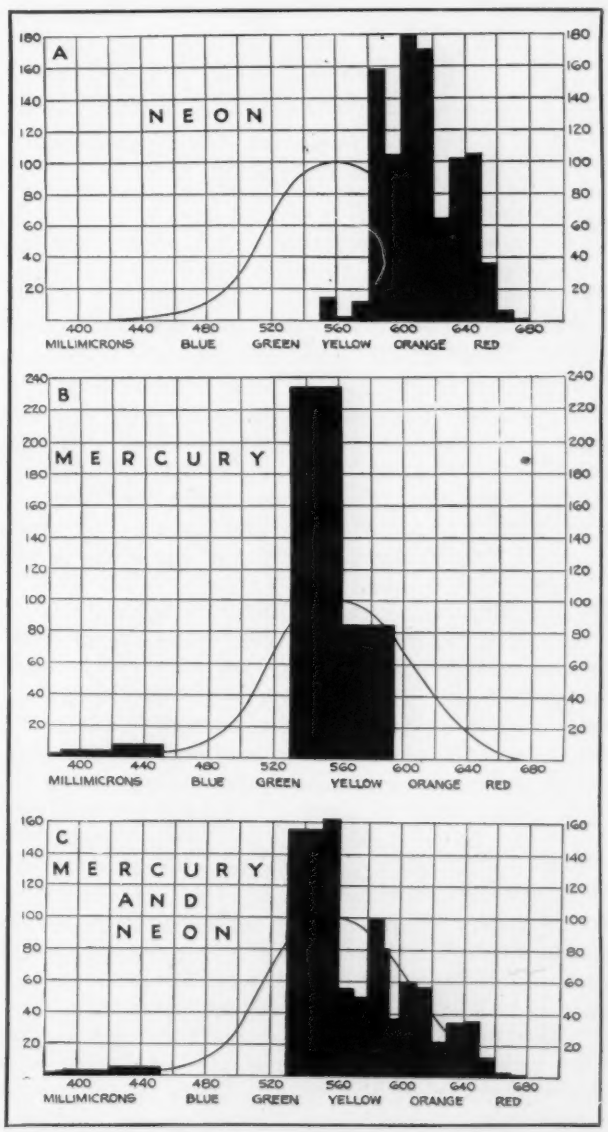


Fig. 3—Luminosity patterns of neon light, mercury light and a neon-mercury combination light

of long and fragile tubular units there has been intensive development, here and abroad, of low-voltage arc lamps for operation directly from 110-volt or 220-volt supply lines or through low-ratio transformers. This development has centered largely around the lamp electrodes.

The voltage drop, and, hence, the energy loss, at the electrodes of a gaseous-conduction lamp is, in general, a constant characteristic of the gas and of the electrode

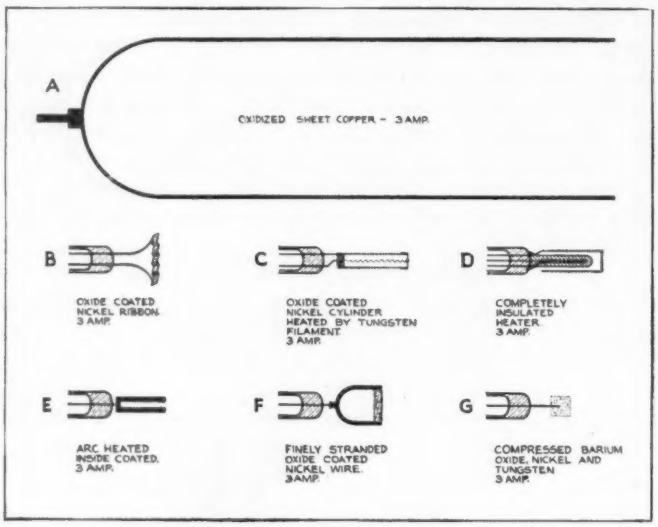

A
OXIDIZED SHEET COPPER - 3 AMP.
B
OXIDE COATED NICKEL RIBBON 3 AMP.
C
OXIDE COATED NICKEL CYLINDER HEATED BY TUNGSTEN FILAMENT 3 AMP.
D
COMPLETELY INSULATED HEATER 3 AMP.
E
ARC HEATED INSIDE COATED 3 AMP.
F
FINELY STRANDED OXIDE COATED NICKEL WIRE. 3 AMP.
G
COMPRESSED BARIUM OXIDE, NICKEL AND TUNGSTEN 3 AMP.

Fig. 4—Types of electrodes used with gaseous conduction lamps

and independent of the voltage drop, hence the length of the gas-filled space between the electrodes. In the case of the so-called rare gases used with cold electrodes of the type shown in Fig. 4A this electrode drop may be of the order of 400 volts, and hence to keep this an efficiently low fraction of the total voltage the luminous tubes must be of such a length as to give more than a thousand volts drop in the gas itself. This high voltage at the electrodes results also in a sputtering of the electrode material onto the adjacent tube walls, an effect which is heightened by increasing electrode temperature and limits the discharge current to about 40 milliamperes per square inch of electrode surface.

It has been found that calcium oxide fused into the surface of a heated platinum electrode permits greatly increased currents for a given temperature and voltage drop and it has recently been discovered that barium oxide gives nickel surfaces similar unique properties as electrodes. The voltage drop properly associated with such an oxide-coated hot electrode is about one-tenth that of a corresponding cold and unactivated electrode, while the current capacity per unit surface is relatively still more favorable, but difficult to compare directly.

These electrodes must be heated to a temperature of about 900 deg. C. and may be conveniently classified on this basis as either "arc heated" or "internally heated." The simplest internally heated electrode is that shown as Fig. 4B, in which current, independent of that forming the gaseous discharge, passes directly through an oxide-coated nickel or nickel alloy ribbon. While the voltage drop on this ribbon may be made very low, the limit is in the correspondingly high current which must be circulated to and from the electrode. Even with potentials as low as two or three volts, there is a tendency for the discharge to localize at the more negative end of the ribbon. To avoid this fault the equipotential electrode shown as Fig. 4C was developed. It consists of a barium oxide-coated nickel cylinder with an axial tungsten spiral heater whose characteristics may be varied to suit any convenient heater voltage except for an upper limit of about 15 volts alternating current, above which there may be a glow discharge and even arcing between the ends of the heater.

For direct-current operation and for some alternating-current circuits it is desirable to operate the electrode heater directly in series with the arc, using the heater for part or all of the series arc-ballasting resistance. In this case, even with two electrodes the voltage drop per heater may be 33 volts. There are also some circuits, both a.c. and d.c., in which it is desirable to operate the heater in multiple with the arc itself. A solution of these problems is shown in Fig. 4D, in which the electrode structure is similar to that of Fig. 4B, except that the heater element is completely buried in non-emitting refractory which insulates it entirely from the gas.

An important limitation of the internally heated electrode is that it must be heated practically to the normal operating temperature before the gaseous discharge is started. This preheating is accomplished most simply by placing in series with the starting device the heater element of a bimetallic circuit-closing switch (Fig. 1B).

The arc-heated electrode is a type intermediate between the older high-voltage cold electrode and the above-described low-voltage, internally heated, oxide-coated electrode. A nickel-barium oxide compound is formed on the surface of a small electrode shell, Fig. 4E, on the surface of stranded or bundled nickel wires, Fig. 4F, or as a compressed pellet supported on the end of an inlead wire, Fig. 4G.

In all cases the mass and heat capacity of the electrode is kept to a minimum to insure a very short interval of under-temperature when the arc is started. The "crater" type electrode shown in Fig. 4E has been used in relatively high-voltage tubes to secure high current capacity in a small space as compared with Fig. 4A and to retain the advantage of high voltage starting. The other two arc-heated electrodes and many similar are being used interchangeably with the internally heated types.

Sunlight approximations are possible

One of the most satisfactory methods of studying the quality of light is by a graphic chart of its luminosity. Thus, if the relative energy distribution of sunlight, Fig. 2A, is multiplied by the eye sensitivity the product is the luminosity curve or pattern of sunlight, its area being a measure of intensity and its detailed form an indication of color quality. The blackened area of Fig. 2A represents, then, uncolored daylight and may be used as a basis of comparison.

Since gases have only line spectra, it is necessary in such a comparison to assign an arbitrary width to them and let their height represent their relative intensity. In Fig. 2C, for example, their line width is such that in combination with the product of the line intensity by the eye sensitivity the total line luminosity area is identical with that of sunlight whose curve is superposed for comparison. Thus, the luminosities represented by all the curves of Figs. 2 and 3 are the same and the variations in form from sunlight luminosity show color

and whether or not it is subjective; that is, produced through the mixture of the complementary colors.

In Fig. 2B is represented the luminosity of the light from a carbon-dioxide tube similar to that used years ago in the Moore color matching lamp. This gives a very close approximation to daylight of the blue quality of north skylight. It is important to notice that there are no gaps in the spectrum, that none of the "whiteness" is dependent upon complementary colors.

In Fig. 2C is represented the luminosity of the light from a helium tube. This, in contrast with the carbon-dioxide lamp, is an outstanding case of apparent whiteness resulting from a mixture of complementary colors. It should be noted in this connection that it is not necessary to have equal luminosities of complementary colors to produce an approximate subjective white. There is, however, in this light an excess of yellow and uncomplemented red which gives to it a peculiar characteristic color and makes it of value for sign-lighting purposes in spite of a very low luminous efficiency.

In Fig. 3A is represented the luminosity of the light from a neon tube. This is an uncomplemented orange red ordinarily seen at so high an intensity that the luminosity lightens the hue to a yellow orange. At low intensities or through red filters this light may appear a fairly clear red, but obviously not a dark red.

In Fig. 3B is represented the luminosity of the light from a mercury lamp. The coincidence between the strongest lines and the maximum eye sensitivity is unique. Although the yellow-green lines actually are more localized in the spectral range than is represented in Fig. 3B, they excite a white luminosity to an extent much greater than suggested by the width of the lines, with the result that complementary blue and violet lines of very low luminosity indeed produce a subjective white of pronounced blue quality. When, however, colored objects are seen by this light, the absence of red and blue-green is evident, especially at low levels of illumination.

In Fig. 3C is represented the luminosity of a commercial mercury-neon photographic lamp for use with panchromatic film. The red is well filled and in practice the absence of blue is not found to be a serious matter.

The only limitation of various similar combinations of gaseous-conduction lamps are those of efficiency, space and economy. The carbon-dioxide lamp has not been more extensively exploited because of inherent limitations in the tendency of the gas to be absorbed by sputtered electrode materials.

Efficiency, lumens per watt, like color, is primarily an inherent characteristic of each gas and is only secondarily influenced by the kind of electrode and the electrical circuit used, by the kind of service and the economic life required. Thus an efficiency rating of any lamp means little or nothing except in terms of standardized commercial units. The following tabulation is on the basis of 500-watt units:

	Lumens per Watt
Sodium arc—experimental	32
Projection incandescent	26
Mercury arc in quartz	21
Incandescent lamp	19
Mercury arc—low pressure	18
Neon—inductive ballast	17
Neon—resistance ballast	13
Tungsten mercury arc	12
Helium—resistance ballast	4

High-voltage neon, helium and mercury lamps in a great variety of sizes have been in continuous operation under severe conditions of outdoor sign service for some years. The newer low-voltage types are rapidly going into similar service as high-intensity beacons and flood-lighting sources.

In conclusion, it may be emphasized that color and efficiency are inherent characteristics of the particular gas used and are but slightly modified by the electrode or circuit used; that gaseous-conduction lamps must, however, always include an auxiliary operating device, ranging from a transformer, choke coil and relay switch to a simple resistance unit concealed in the base of the lamp tube, and that although depreciation data over long periods are not yet available for commercial units, it is certain that they can be rated for long life and low depreciation without a serious sacrifice of efficiency.

▼

Rubber-Covered Wire Made in Continuous Process*

By S. E. BRILLHART
Western Electric Company, Baltimore

A NEW plant has been established at Baltimore in which certain unique methods and departures from conventional methods of manufacturing rubber-covered wires have been reduced to practice on a large scale. A single-story building of 300,000 sq.ft. floor area has been erected which ultimately will be devoted exclusively to the manufacture of insulated wires. The first section of the new plant, equipped to produce only the drop wires required by the Bell Telephone System, has a capacity of 500,000,000 pair feet annually. It is now being expanded to include the manufacture of all other rubber-covered telephone wires required.

In a conventional wire-insulating plant the rubber compound is manually fed into a forcing or tubing machine which extrudes it upon the wire. The conductor with its unvulcanized covering is received from the delivery side of the tubing machine and coiled in pans or wound on large steel drums which must later be introduced into a steam-vulcanizing oven, where they are heated and the rubber covering vulcanized under steam pressure for several hours. When coiling in pans the insulated wire is laid in a layer of powdered soapstone or sifted chalk and each flat coil of wire separated from the ones next to it by more of the same material.

This entire sequence of operations is performed in the new plant on a machine unit schematically shown by Fig. 2, which has been developed for insulating and vulcanizing the wire continuously in a single operation.

No. 14 made at 400 ft. per minute

The path of the wire through the unit is from the reels mounted on the bare-wire supply stands into and through the insulating tool head attached to the cylinder

**Abridgment of "The Manufacture of Rubber-Covered Wires for Telephone Installations," presented at the recent A.S.M.E. National Process meeting, Buffalo, N. Y.*

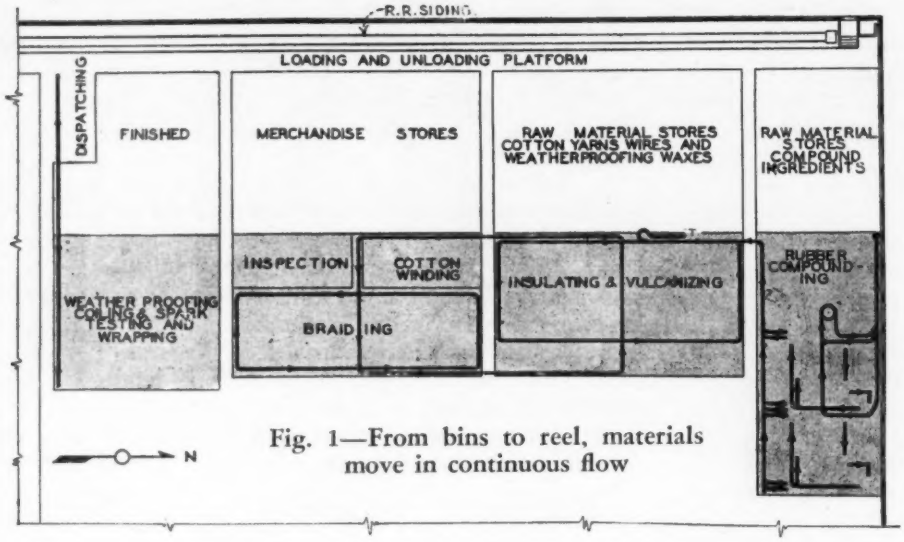


Fig. 1—From bins to reel, materials move in continuous flow

of the tuber, wherein the compound is extruded upon it, into the stream-jacketed vulcanizing tube, out into the exhaust hood through the steam seal in cured condition, around the sheave in the hood and through the cooling spray back to the wire-drive capstan, and around this member to the insulated wire take-ups, where it is wound on the reels required for handling at the braiders.

As an indication of the output speeds obtainable with the unit, No. 14 code wire can be produced successfully at speeds up to 400 ft. per minute. Nos. 19 and 20 gage wires are insulated singly at 600 ft. per minute, and smaller gages, such as No. 22, having a considerably thinner wall of insulation, at 1,000 ft. per minute.

The process as a whole and the unit itself form the most important single machine development in the new plant, because they make possible close quality control by subjecting all the insulation to precisely the same curing conditions of time and temperature. Also, because by making possible close size control and relatively high productive outputs they effect substantial economies.

As a result of using an accurate and inflexible tool head it is possible to produce continuously rubber-insulated wire with outside diameters only 3 per cent greater than the minimum permissible diameter, and without imposing a burden of watchfulness upon the operator.

Vulcanization takes place in the time required to pass the insulation through the 100-ft. long vulcanizing tube, which, for example, in running No. 17 B.P. drop wire, is sixteen seconds. During this time the covering is exposed to an atmosphere of saturated steam maintained at a pressure of 200 lb. per square inch. This high-speed cure is made possible by a well-balanced compound in which a very quick-acting accelerator is used.

The cotton braid which covers the rubber insulation is applied to the drop wires on sixteen-carrier commercial rotary braiding machines and Western Electric high-speed braiders which operate at 330 r.p.m.

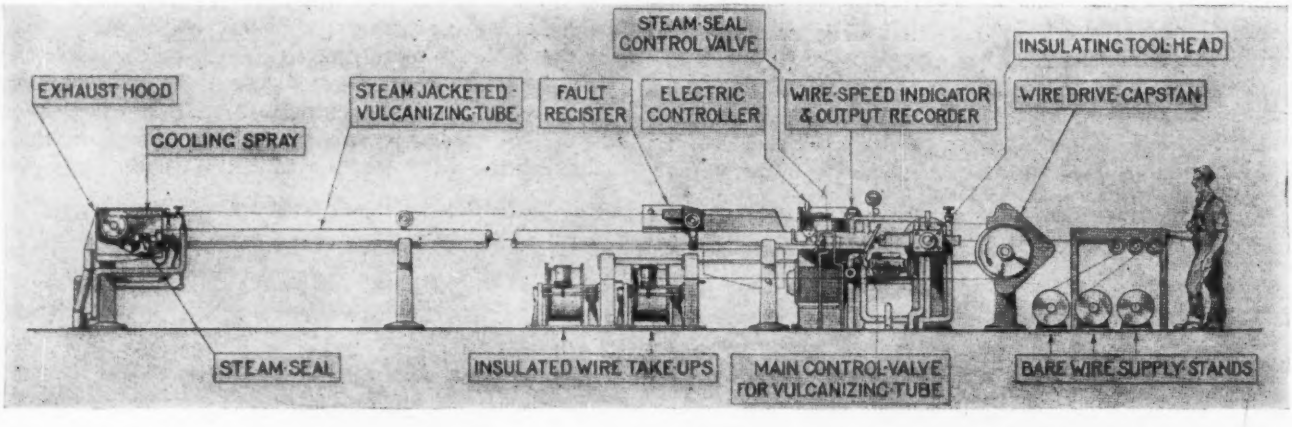
The saturant and wax used to weatherproof and finish the braided wire are applied in an improved machine consisting essentially of two steam-heated tanks in which the materials are held at the proper temperature for application through which eight separate wires may be passed simultaneously.

Electric test applied automatically

A high electrical potential is applied to the two lengths of electrode so that, as the wire is being coiled, a running test for continuity of the insulation is made. If a fault occurs a current flows from the electrode through the fault to the grounded conductor, which serves to operate certain relays, which in turn stop the machine at once, light a lamp and sound a signal. The fault can then be patched or removed. If no fault is located the machine continues to coil the wire until a predetermined length, in most cases 1,000 ft., has been taken up by the capstan. It then automatically stops and the operator cuts the wire, revolves the second of the two capstan heads into position for coiling and starts the machine again, while he binds the coil just completed, removes it from the capstan and places it upon the rack which separates the coiling from the wrapping section.

After spark-testing and coiling, the coils of wire are wrapped with crêped paper on conventional wrapping machines such as are used for wrapping automobile tires and are then ready for delivery to merchandise stock or shipment.

Fig. 2—Rubber applied and vulcanized on in a single machine at high speed



25,000 Off-Peak Water Heaters Used in Amsterdam

NEARLY 25,000 electric water heaters are in use on the Amsterdam, Holland, electric light and power system, according to Dr. W. Lulofs, manager of the Gemeente-Elektriciteitswerken. They have been very helpful in offsetting the load reductions that normally occur during the night, around noon and between Saturday noon and Monday morning. Development of this extensive usage has been accomplished through co-operation of the utility company and authorized contractors, the latter doing the wiring and plumbing and most of the canvassing.

Of the 24,689 water heaters in service on September 17, 1931, about 84 per cent are rented. Although there were 895 units in service at the beginning of 1927 (which number was practically tripled that year), it was not until the practice of renting the units was started in 1929 that the biggest increase in usage was brought about.

Forty-liter (9 gal.) heaters seem to meet most of the hot water requirements, as 65 per cent of those in use are of this capacity. However, 21.5 per cent are 80-liter and 8.4 per cent 150-liter units. The load ranges from 13.7 watts per liter for the 40-liter size to 13.2 watts per liter for the 250-liter size. The heating elements operate on 220-volt, 50-cycle power.

The price of the water heaters without accessories ranges from about $40 for the 40-liter size to $106.50 for the 250-liter tanks. Installation cost adds about $12 and $16 respectively to these prices. But, as previously stated, only about 16 per cent of the installations are sold for cash (no installment payments) and most are rented. The rental ranges from $0.76 for the smaller units to $1.73 per month for the 250-liter tanks and figures around 17 to 17.5 per cent yearly on the cost installed.

Off-peak power is used chiefly for water heating. A time switch in the meters connects the heaters from 11 p.m. to 7:30 a.m. and from 12 noon to 2 p.m. daily, and from 12 noon Saturday to 7:30 a.m. Monday. During the summer the off-peak periods are shifted one hour later. Off-peak service is charged at a rate of 0.8 cent per kilowatt-hour. However, if the hot water requirement is larger than usual the consumer can connect the units at other periods and pay 1.6 cents per kilowatt-hour during such usage. Synchronous clocks in the meters perform the automatic switching and also set the "off-peak" or "on-peak" rates. (The off-peak rates for water heating in the United States extend from $\frac{3}{4}$ cent to $1\frac{1}{2}$ cents per kilowatt-hour, while the rates for unrestricted service usually depend on the amount of energy and seldom drop below 2 cents.)

To calculate the size of water heaters required, it is assumed, says Dr. Lulofs, that the consumption of hot water in the kitchen averages 5 liters per person per day and reaches a maximum of 8 liters. For baths it is assumed that about 60 liters at 80 deg. C. is required per person per bath. Water is heated to 80 deg. C. and normally delivered at the same temperature to the taps.

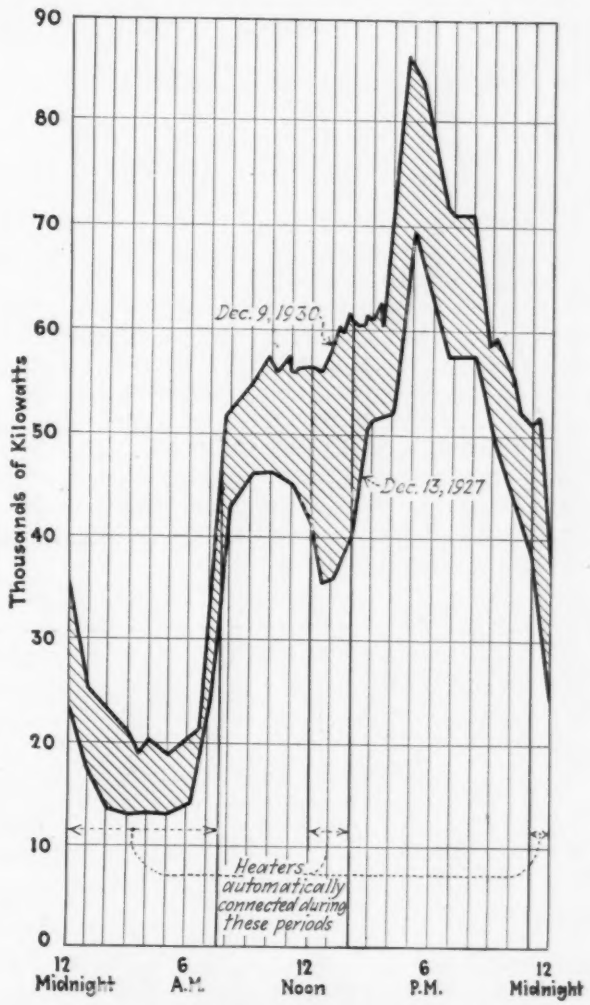


Fig. 1—Night load raised and noon valley eradicated by water heating

These curves show system loads on a Tuesday for December 13, 1927, and December 9, 1930. Refer to Table II for number of water heaters in use at these times. The increase in load between 7:30 a.m. and 12 noon and between 2 p.m. and 11 p.m. is not due to water heaters, as other loads had been added during this interval, but the effect on the night and noon valleys is chiefly due to water heating.

On December 13, 1927, the measured output was 906,000 kw.-hr. and the load factor 55 per cent. The weather was rainy and the temperatures at 6 a.m. and 4 p.m. were 33 and 38 deg. F. respectively. On December 9, 1930, the output was 1,232,000 kw.-hr. and the load factor 59 per cent. The weather was cloudy and the temperatures at 6 a.m. and 4 p.m. were 39 and 40 deg. F. respectively.

Although some rate experts and commercial managers in the United States fear that the establishment of an off-peak rate in addition to existing domestic schedules will confuse the customer and require a lot of explaining to show the justification of the differential, Dr. Lulofs reports that the 2:1 ratio of the unrestricted-use charge to the restricted-use charge in his country has raised no difficulties and is acceptable to the public.

The influence of this water-heating load on the system is illustrated by the accompanying curves. It will be observed that the load between 11 p.m. and 7:30 a.m. has been increased nearly 50 per cent, giving a minimum night load of 19,000 kw. instead of 13,000 to 13,500 kw. Furthermore, the 12 noon to 2 p.m. drop of nearly 10,000 kw. has been eradicated. It is true that the day peak around 5 p.m. has increased about 25 per cent, but this is due chiefly to other day loads that have been added in the three-year interval represented by these curves.

Commenting on these curves, Dr. Lulofs says: "Though it is possible to switch the heaters on by hand outside the off-peak hours mentioned, it is done to only a small extent. The load increase between 7:30 a.m. and 12 noon and between 2 p.m. and 11 p.m. is due almost exclusively to increases in normal day load, namely, power, and household consumption of electric radiators and similar apparatus.

"Due to the introduction of the night-current tariff, the number of hours' use of the maximum load (annual kw.-hr. ÷ max. kw.) increased from 3,110 to 3,310 (from 1929 to 1930) and amounted to 3,620 hours in 1931. To a smaller extent these increases have been caused by domestic appliances which are not restricted to night hours or from 12 to 2 p.m., including radiators, vacuum cleaners, flat irons, water heater for day use, etc."

The added load developed by the "night-current tariff" is indicated by Fig. 2 a and b.

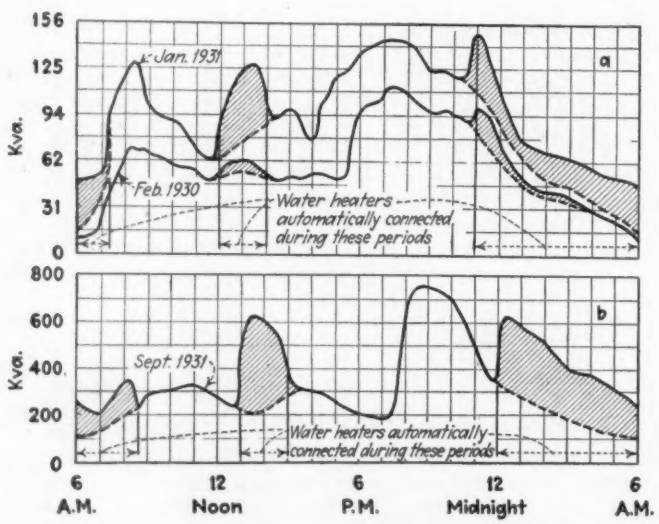


Fig. 2 a and b—Load curves in two districts having a large number of water heaters

Observe the increase in night and noon load. The dashed lines indicate rough approximations of what the load might be if it were not for the water heaters. The peak at 8:20 a.m. (a) is caused by the lighting load; apparently on that day it was very dark in the early morning; (b) shows a one-hour delay in automatic connection of water heaters due to the fact that the summer schedule of automatic connection was still in force on September 8.

Table I—Most of the Water Heaters in Amsterdam Are Rented

(Number of Water Heaters in Operation on September 17, 1931)

Capacity of tanks in liters.	25	30	35	40	60	80	100	150	250	400	600	Total
Sold.....	949	1	1	1,602	1	89	4	1,085	195	10	2	3,939
Rented...	...	..	..	14,427	..	5,220	..	987	115	1	..	20,750
	949	1	1	16,029	1	5,309	4	2,072	310	11	2	24,689

Table II—Use of Water Heaters in Amsterdam Increased 150 per Cent During 1930

Date	Sold	Rented	Total
January 1, 1927.....	895	.....	895
January 1, 1928.....	2,505	.....	2,505
January 1, 1929.....	3,345	.....	3,345
January 1, 1930.....	3,805	2,911	6,717
January 1, 1931.....	3,912	12,864	16,776

Table III—Prices and Rental Rate of Different Size Water Heaters Used in Amsterdam

Contents in liters.....	40	80	150	250
Capacity of heating element in kw. at 220 volts	0.55	1.1	2.2	3.3
Rent per month (florins*).....	1.90	2.30	3.30	4.30
Price of water heaters without accessories (florins*).....	99.50	145.00	195.00	265.00
Price installed (florins*).....	129.50	175.00	235.00	305.00
Price of installation (florins*).....	30.00	30.00	40.00	40.00

*Dutch guilder or florin = 40.2 cents.

The revenue from renting night-current heaters may be roughly calculated from the rental in Table III and the number of heaters given in Table II, says Dr. Lulofs. The revenue from "night current" at 0.8 cent per kilowatt-hour was upward of $40,000 in 1928, $64,000 in 1929, $144,000 in 1930 and about $288,000 in 1931. For the greater part this revenue came from off-peak heaters, principally the 40, 80, 100 and 250-liter tanks, the yearly consumption of which is estimated at 1,450, 2,000, 3,000 and 4,800 kw.-hr. respectively. New measurements are being taken on about 100 heaters. Normally the heaters' consumption is not measured separately. The whole installation, including lighting, is switched over to the 0.8-cent rate from 11 p.m. to 7:30 a.m. and from 12 noon to 2 p.m. Consequently lighting and other uses are included in the figures given.

The day-current consumption of heaters is considerably less. In general, the day-time heaters are chiefly 6 and 17-liter tanks, with an estimated yearly consumption of 1,100 and 2,000 kw.-hr. respectively. The total yearly consumption is about 5,000,000 to 10,000,000 kw.-hr., compared with about 36,000,000 kw.-hr. for night current in 1931. The number of day-current heaters increases very little.

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Canadian Homes 72 per Cent Wired

Of the 2,142,805 homes in Canada, it has been estimated that 1,436,777, or 72 per cent, are wired for electricity, according to a recent survey by a company manufacturing electric appliances. In these homes during 1930 electric appliances alone consumed a total of more than 908,000,000 kw.-hr. of electric current. According to the report on the census of central stations for 1930, which has just become available, the number of domestic and farm customers at the end of that year was 1,317,324.

Diesel Energy Costs in 1.7 to 3-Cent Range

COSTS of electric power from Diesel engine drives have shown a pronounced tendency toward a "gunshot" manifestation even when the experience of a considerable number of plants has been graphed. Many variables are present to contribute to a wide departure from uniformity. Data, however, have multiplied lately and an analysis shows a much higher degree of correlation and rationality than has usually been observable heretofore. The subcommittee on oil engine power costs of the A.S.M.E. Oil and Gas Power Division has published a report covering 94 plants containing 283 engines totaling more than 160,000 hp. The general power committee of the N.E.L.A. has more recently published cost data for 251 Diesel engine plants. All plants in the A.S.M.E. list are incorporated in the N.E.L.A. report.

A cursory examination of this mass of cost data will give a first impression that the spread of values is so great as to make averages unreliable and unindicative of a representative situation. More careful analysis and restriction of the samples shows, however, a rationality that has not been a characteristic of previously published data. For 26 plants the data as to capital outlay and operating expenditures are given in full detail. Some of these plants are, however, standby plants, for which discordant results naturally exist by comparison with plants operating on a steady schedule of municipal or industrial service. The selection, therefore, narrows to eighteen plants, seventeen of which are municipal utility plants. Of these seventeen plants eight have water-pumping load in addition to light and power load. One is an industrial plant.

These eighteen plants comprise 56 engines with a total rating of 19,714 kw. Their combined output was more than 40,000,000 kw.-hr., representing a group having reported load factors ranging from 25.6 to 41.8 per cent on an annual basis. Actually, a better index of the load factor range can be derived from the fact that eight of the eighteen plants had annual load factors between 30 and 40 per cent. The running plant capacity factors range from 33.3 to 75.2 per cent. In the case of several plants it appeared that the reported peak load encroached seriously upon or even exceeded the capacity available with the largest unit out of service. Plant service factors in the group analyzed have a reported minimum of 29.9 per cent and a maximum of 85.8 per cent. As was to be expected, the 1,230-kw. plant, having the high plant service factor of 85.8 per cent, showed a relatively low total annual charge per kilowatt-hour. The annual load factor for this plant, although not reported, must have been relatively high. Nine of the eighteen plants fell between the limits of 40 and 60 per cent for plant service factor.

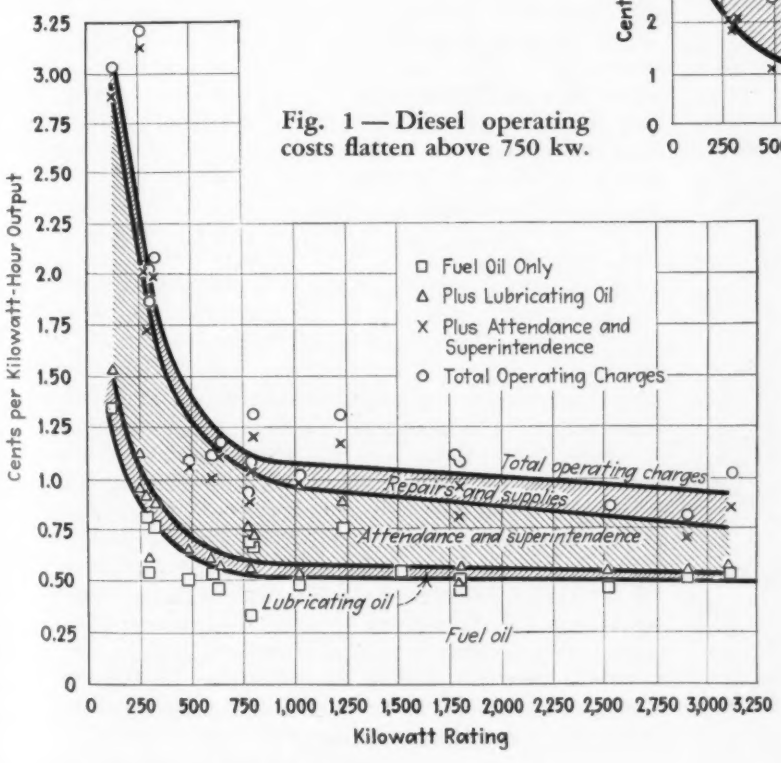


Fig. 1 — Diesel operating costs flatten above 750 kw.

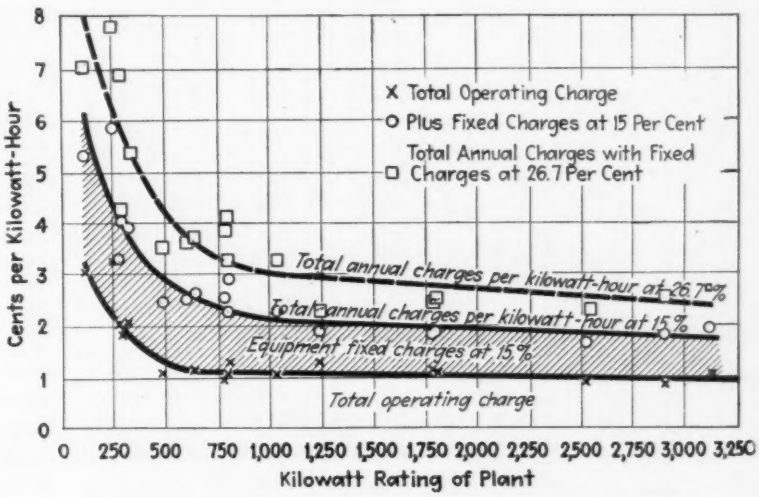

Cents per Kilowatt-Hour
Kilowatt Rating of Plant
× Total Operating Charge
○ Plus Fixed Charges at 15 Per Cent
Total Annual Charges with Fixed
□ Charges at 26.7 Per Cent
Total annual charges per kilowatt-hour at 26.7%
Total annual charges per kilowatt-hour at 15%
Equipment fixed charges at 15%
Total operating charge

Fig. 2—Fixed charges determine over-all cost of Diesel kilowatt-hours

Plants show rational cost characteristics

These facts show a reasonable degree of homogeneity for the conditions under which the plants operate and therefore

Unit Costs for Eighteen Diesel Generating Stations

1 Plant No.	52	45	130	7	41	176	132	13	616	182	69	74	527	501	335	247	353	265
2 Total kilowatts	3,110	2,900	2,524	1,795	1,800	1,230	1,030	800	785	775	640	600	480	315	295	275	250	110
3 No. of engines		3	4	5	3	3	3	3	3	3	2	3	2	3	2	3	3	2
4 Years of installation	1928–30	1922–6	1924–8	.....	1912–28	1926–8	1929	1923–5	.....	1920–30	1927	1924–8	1929	1925–9	1919–24	.....	1916–27	1927
5 Type of load	M	M	M	M	M W	I	M	M W	M	M W	M W	M W	M W	M	M W	M W	M	M
6 Equipment investment ($)	460,183	458,227	240,398	159,590	217,380	174,802	123,546	121,500	128,900	117,480	109,000	94,000	63,000	50,500	63,321	36,500	46,600	27,338
7 Cost per kilowatt ($)	148	158	95	89	121	142	120	152	164	152	170	157	131	160	214	133	186	248
8 Fixed charges at 15% ($)	69,027	68,735	36,060	23,938	32,607	26,220	18,531	18,225	19,335	17,622	16,350	14,100	9,450	7,075	9,498	5,475	6,990	4,101
9 Fixed charges at 26.7% ($)	122,869	122,326	64,186	42,611	58,040	46,672	32,987	32,440	34,416	31,367	29,103	25,098	16,821	13,484	17,708	9,746	12,442	7,289
10 Net kilowatt-hours	7,257,703	6,908,500	4,484,700	3,211,821	4,068,290	4,603,075	1,446,160	1,553,500	1,131,661	1,072,530	1,123,340	1,010,212	673,300	403,022	432,940	428,290	268,077	184,000
11 F. C. per kw.-hr. at 15% (cents)	0.949	0.995	0.804	0.746	0.301	0.569	1.281	1.205	1.611	1.643	1.455	1.395	1.404	1.880	2.195	1.278	2.607	2.229
12 F. C. per kw.-hr. at 26.7% (cents)	1.693	1.771	1.431	1.326	1.427	1.014	2.281	2.867	2.216	2.924	2.591	2.485	2.505	3.345	4.090	2.275	4.641	3.962
13 Fuel cost per kw.-hr. (cents)	0.530	0.519	0.459	0.452	0.509	0.758	0.498	0.660	0.483	0.699	0.469	0.532	0.502	0.758	0.545	0.812	0.952	1.348
14 Lubr. oil cost per kw.-hr. (cents)	0.038	0.009	0.083	0.035	0.048	0.138	0.032	0.065	0.085	0.059	0.096	0.080	0.159	0.180	0.057	0.110	0.174	0.176
15 Attendance cost per kw.-hr. (cents)	0.283	0.177	0.176	0.317	0.408	0.281	0.451	0.488	0.481	0.134	0.545	0.398	0.397	1.058	1.101	1.079	1.993	1.358
16 Repairs, supplies per kw.-hr. (cents)	0.178	0.115	0.176	0.307	0.115	0.136	0.034	0.101	0.039	0.051	0.080	0.123	0.033	0.085	0.151	0.011	0.096	0.181
17 Total operating cost per kw.-hr. (cents)	1.029	0.820	0.860	1.111	1.080	1.313	1.015	1.314	1.088	0.943	1.190	1.133	1.091	2.081	1.854	2.012	3.215	3.063
18 Over-all cost per kw.-hr. at 15% (cents)	1.978	1.815	1.664	1.857	1.881	1.882	2.296	2.925	2.293	2.586	2.645	2.528	2.495	3.961	4.049	3.290	5.822	5.292
19 Over-all cost per kw.-hr. at 26.7% (cents)	2.715	2.591	2.291	2.437	2.507	2.327	3.296	4.181	3.304	3.867	3.761	3.618	3.591	5.426	6.944	4.287	7.855	7.025
Other Data																		
20 Average cost of fuel oil (cents per gal.)	5.70	5.29	4.72	4.79	5.19	7.70	4.64	5.69	5.10	6.00	3.50	5.53	3.87	5.50	4.85	6.00	5.50	9.14
21 Average cost of lubr. oil (cents per gal.)	71.1	48.0	56.7	51.1	58.8	75.7	50.0	39.7	70.4	54.0	56.0	54.0	65.0	55.3	59.9	55.0	44.0	59.9
22 Annual load factor (per cent)	33.5	34.9	41.8	.....	39.2	.....	33.9	32.7	37.2	.....	41.4	.....	.....	32.5	38.5	28.9	25.6	.....
23 Peak load (kw.)	2,520	2,450	1,300	1,060	1,200	1,020	575	450	520	560	350	375	320	148	145	170	126	80

M = Municipal electric service. M W = Municipal plant with water pumping. I = Industrial power plant.

justify attaching a large amount of importance to the resulting over-all costs of Diesel-produced power. Note that this statement is made only for the over-all costs of these eighteen plants and not for the constituent cost elements. Examination of the table herewith shows a considerable range for investment costs per kilowatt, for fuel and lubricating oil consumption and for attendance labor. This can be seen from the two charts also. But there is a higher degree of correlation of the total operating costs than there is for the individual components of this total. The "gunshot" characteristic is so far missing as to justify a representative curve.

Almost as much can be said of the over-all annual cost per kilowatt-hour, including carrying charges on investment, whatever percentage be chosen as appropriate. Naturally, however, the wide range of capital outlay per kilowatt spoils the correlation somewhat for this total, when the corresponding carrying charges have been added to total operating costs, which show good correlation.

Wide spread of individual components

It should be borne in mind that these figures make no allowance for variation of such differentiating factors as quality or cost of fuel oil and lubricating oil, reclamation accessories for the latter, centrifuging practice, credits for utilization of exhaust and jacket water heat, labor costs or working hours. Undoubtedly credit or debit for such items was incorporated in the figures as reported. One plant reported paying as high as 9 cents for its fuel oil and another as low as 3.5 cents; likewise, the annual average for lubricating oil ranged from 39.7 to 75.7 cents per gallon.

Another fact to observe is that, with the exception of one industrial plant, the group consists of municipal plants rendering utility and water-pumping service. This group is not reputed to have as high a degree of uniformity in accounting practice as private utilities under regulation. On the other hand, it would be expected to report costs as low as consistent with the facts. Admittedly the extension of the operating cost data to include the 251 plants in the N.E.L.A. report and the 94 in the A.S.M.E. report would show a wider spread and therefore less justification for inferring averages. The present analysis has been confined to a homogeneous group for which over-all costs per kilowatt-hour can be computed from full data about investment and operation, and this is what matters, anyway.

The crux is the fixed charge

As to fixed charges, there can be endless argument. What rate for interest on the investment? What for taxes? Shall a municipal plant charge itself taxes at all? What is the useful life of a Diesel installation and what, therefore, should be included to cover sinking fund, retirement, amortization?

Here the practice and the theory will differ widely between municipal power plants and industrial power plants. The former will in general be able to get capital at lower rates than industrials, be in a position to claim validity for excluding the tax item and also to urge a lower rate of depreciation. Industrial plants are prone to look upon the power generation equipment in much the same way as they do upon their productive machinery. At this point the N.E.L.A. committee publication cites "Recent Economic Changes in the United States" (a phase of the report of President Hoover's Conference on

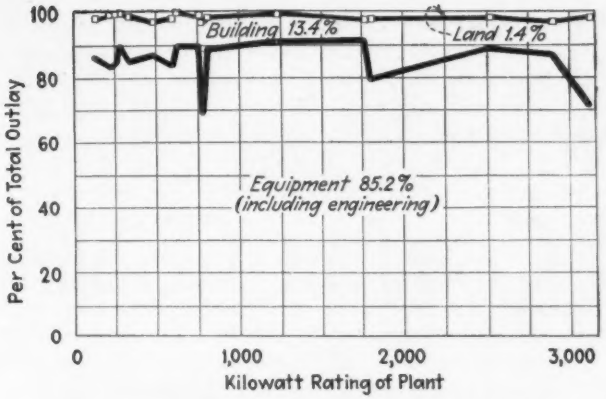


Fig. 3—Land and building add one-sixth to investment cost

Unemployment) with respect to the policy of American manufacturing plants in purchasing new equipment. All the plants were found to figure that equipment must pay for itself in five years or less. Sixty-four per cent expect equipment to pay for itself in 2½ years or less. Taking, however, the longer five-year period, it would require an amortization increment of 17.7 per cent of the investment costs annually, in conjunction with 6 per cent compound interest and 3 per cent for taxes and insurance, to clear the books in five years of the plant entry. This is the basis of the upper curve, labeled 26.7 per cent, in the diagram. On this basis industrial plants of 1,000 to 2,500 kw. capacity having load characteristics comparable to the municipal plants, on which the bulk of the data here are based, cannot expect to fall far outside the range of 2.5 to 3 cents per kilowatt-hour energy cost unless they are favored by lower oil, lower labor and lower initial plant outlays than prevailed in 1930 and 1931.

Municipal cost 1.7 to 2.2 cents

Municipal plants will in general be more disposed to favor estimating a longer useful life for Diesel power plants—maybe twelve to fifteen years would be a representative claim. A 15 per cent total fixed charge would approximate an economic life of this order of magnitude in conjunction with 6 per cent for interest and 3 per cent for insurance and taxes. If taxes are ignored and money can be obtained for less than 6 per cent, then 15 per cent fixed charges would be adequate for amortization over a still longer period. But taking 15 per cent as a significant minimum, it appears that municipal plants in this range of 1,000 to 2,500 kw. will make a kilowatt-hour for from 2.2 to 1.7 cents.

Somewhere between these two curves for 15 and 26.7 per cent fixed charges will fall the general run of Diesel costs for 1,000- to 2,500-kw. plants if these joint data are to be accepted as authentic and unit prices do not drop, but stay substantially below those cited. The industrial plants which follow the practice of amortizing plant investment in less than five years, as many do, will, on the basis of this analysis, find their kilowatt-hour costs to be even higher than the range of 2.3 to 3 cents. Plants below the 250-kw. rating show average over-all costs of 4 and 6 cents for those following respectively the trend of municipal and industrial accounting for depreciation.

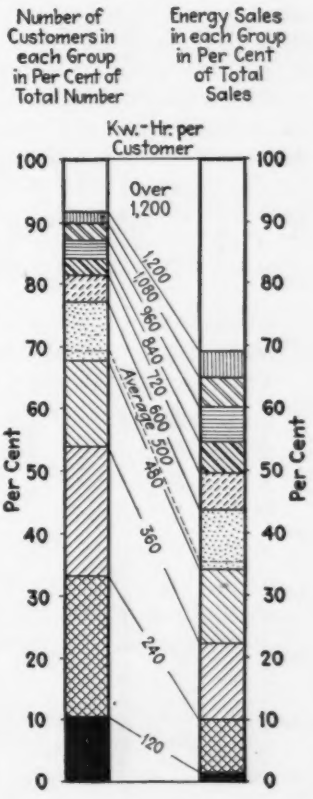
The data seem to show fairly conclusively that the costs of repairs and supplies per kilowatt-hour increase with the size of the installation. This runs counter to the usual experience with steam plants. It may be a fortuitous result of taking an insufficient number of samples or it may be the result of more careful cost accounting in the larger plants. This item for current maintenance and miscellaneous supplies seems to have no simple relation to load factor. Thus two plants with load factors between 25 and 30 per cent have respective maintenance expense of 0.011 and 0.096 cent per annual kilowatt-hour, an almost ten to one ratio. A group of five plants having load factors between 32.5 and 35 per cent show maintenance costs per kilowatt-hour all the way from 0.034 to 0.178 cent per kilowatt-hour.

Variation in the proportions of the cost of shelter for the equipment and land allocated to it are not so great as to preclude the inference that, on the average, the cost of the equipment installed, with engineering expense included, represents only about 85 per cent of the total capital commitment. The building accounts for 13.4 per cent and the land 1.4 per cent.

▼

Two-thirds of the Customers, One-third of the Energy

Recently an analysis was made of the domestic business of one of the utility companies of the United Gas Improvement Company group. The average annual energy consumption per customer was found to be very close to 500 kw.-hr. But while 69.5 per cent of the total number used only the average amount, or less—that is, only 30.5 per cent exceeded the average—these 69.5 per cent used altogether only 35.4 per cent of the total energy sold for domestic purposes. Roughly, two-thirds of the customers used only one-third of the energy. In the lowest group, those taking not more than 120 kw.-hr. during the year, we find 10.4 per cent of the whole number; the whole group used 1.5 per cent of the energy. At the other end of the scale, those taking more than 1,200 kw.-hr. are 7.9 per cent of the customers. They used more than 30 per cent of the energy sold to domestic consumers.



Domestic customers and energy sales classified

The chart shows the classification into eleven groups. In the left-hand bar is shown the percentage which each group constitutes numerically, compared with the whole number. The right-hand bar shows their proportionate shares of the energy.

Power Sales Grow with Iced Comfort Cooling

By EMERSON A. BRANDT
Secretary Technical Department, National Association of Ice Industries

Ice for air conditioning promises to furnish a large outlet for electric power.

Extends possible comfort-cooling market to include many residences and small business places where initial investment must be low.

AT THE present time the manufacture of ice provides one of the largest markets for electric power, but the development of iced-comfort cooling promises to increase the market for ice to such an extent that the industry will soon be the largest industrial power user in this country. It does not now appear unreasonable to expect with this new development that the ice industry will be using more than 4,000,000,000 kw.-hr. annually within a very few years. In addition to simple considerations of the great volume of power sales to be had through this development are the really ideal characteristics of the ice plant load, which add greatly to its desirability from the standpoint of the power company. The ice plant load is not only a seasonal off-peak load but it is also a very steady, 24-hour load at times, and the increased consumption through the agency of the ice-comfort-cooling application will possess these same characteristics. Yet this whole development has come along with such rapidity that few men in the electrical field realize its great significance to them.

Undoubtedly a large amount of ice will be sold for comfort cooling during the next few years. The potential market is several times the present ice production. By reason of this fact the central station will sell a greatly increased amount of power. The amount of this additional load can best be understood on the basis of present consumption and a study of the units involved is interesting. For every ton of ice produced in an electric driven plant there is a consumption of 55 kw.-hr. of electrical energy. The present annual production of manufactured ice is 60,000,000 tons. Of this total, 72 per cent, or 43,000,000 tons, is produced with central station power. This represents a present annual consumption of 2,365,000,000 kw.-hr. in ice manufacture.

That is an exceedingly large amount of power and without any additions is most worth while to the central station. Bear in mind also that this load represents ice used in general commercial and domestic channels and that a relatively small portion of it is at present employed in air conditioning. The figures as presented are based upon the survey of power consumption in ice manufacture made by the National Electric Light Association in 1931. It is worthy of note that the large volume of power consumption for ice manufacture has increased steadily through the years without recession.

The development of iced-comfort cooling now promises to increase the present power consumption of the ice industry to a total which is amazing when based upon the most conservative analysis. Such analysis evidences the fact that the use of ice for comfort cooling will bring an increased consumption of 50 per cent in a relatively short space of time. This would involve an increased power consumption of 1,200,000,000 kw.-hr. annually in the manufacture of ice, which is only a part of the incidental consumption.

The market for comfort cooling is so large that it can only be analyzed in sections. Consider first the residence field, which at the present time holds the greatest interest for many utility men. There has been very little application of comfort cooling in the residence field because of the fact that it has had little attention up to the present time. While every one is very much interested in having a comfortable residence, it has been much easier to sell comfort cooling in the commercial field, where its economic benefits in the form of increased business have markedly lowered normal sales resistance. Then, too, before ice entered the field comfort-cooling equipment did not possess the simplicity or low cost required for wide application in the residence. The characteristics of ice comfort cooling embodied in low first cost, simplicity, dependability and ease of operation are the requisites of the residence installation. The limiting factor is then ability to afford the installation, but that is not a restrictive limit in the case of iced-comfort cooling, because hundreds of thousands of families annually absorb more in depreciation on their automobiles than it would cost them to own and operate an iced-comfort-cooling system in their homes. Saturation in this small portion of the field offers a consumption equal to the present total sales of ice.

A specific survey embracing the barber and beauty shops, professional offices, general offices in major buildings, apparel and specialty shops and stores in a metro-

politan area showed that the potential consumption of ice in that field alone was more than equal to the present volume of ice sales. General surveys which have been made indicate that the field for the use of ice in comfort cooling is 250 per cent of present sales. No mention has been made of the ice used in cooling railway passenger coaches, although ice bids fair to carry a great portion of the load in that section of the comfort-cooling application. In the light of these analyses, it is not too optimistic to declare that the use of ice in comfort cooling will shortly bring about a 50 per cent increase in the total ice production. This will be attended by a like increase in the power consumption to make the ice.

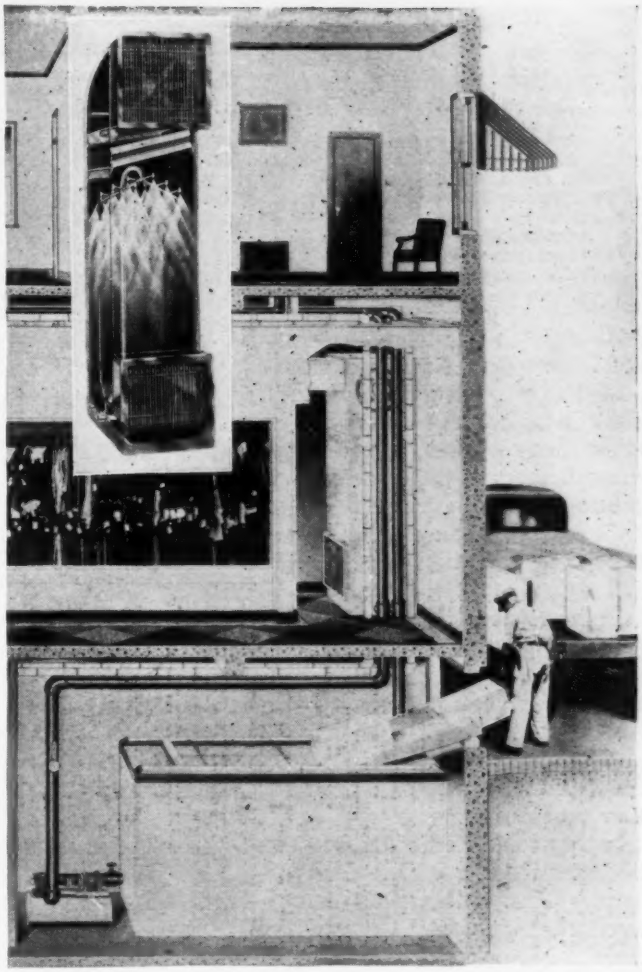
Power used also to melt ice

In the foregoing analysis the data have treated only with the power consumed in freezing the ice, but this is not the total power consumption entailed in the iced-comfort-cooling operation. The water in the system is held at the proper low temperature by constant circulation over the ice. This operation requires motor-driven pumps. The air is also kept in circulation through the cooling system by means of motor-driven fans or blowers. Operation of the ice system, therefore, creates power consumption on the part of the user. This power, which is consumed on the premises of the user, is in addition to the power employed in making the ice. The type of iced-cooling system, whether it is a unit system or a larger contralized system, governs the amount of power employed in this phase of the work. Utilization of the ice in the unit systems averages 10 kw.-hr. per ton of ice melted, while the centralized system consumes an average of 20 to 25 kw.-hr. per ton of ice melted. A composite average then indicates a power consumption of 16 kw.-hr. per ton of ice melted in comfort cooling. This amount of power will be consumed in the iced-comfort-cooling system in addition to the power employed in making the ice. Where electric power is employed in making the ice each ton melted in a comfort-cooling installation then represents 55 plus 16 or 71 kw.-hr. of electric power purchased.

Simple addition then shows that the power industry will shortly be possessed of the following annual business from the ice industry and in connection with the utilization of ice in comfort cooling:

Ice manufacture 72 per cent of 90,000,000 tons × 55 or 3,544,000,000 kw.-hr.
Ice utilization 30,000,000 tons × 16 or 480,000,000 kw.-hr.
Total consumption annually 4,024,000,000 kw.-hr.
Ice plant load factor is basis of economy.

If refrigerating machinery were installed for each comfort-cooling job the power consumption for production of the refrigeration job would be about 35 kw.-hr. to produce the same effect as a ton of ice in melting, while the ton of ice represents a consumption of 55 kw.-hr., or 60 per cent more power. There are several fundamental reasons why the ice manufacturer is able to supply the ice at attractive rates, despite the fact of this disparity in power consumption. The requirements for comfort cooling fluctuate widely during the summer season, because there is relatively little stability about the weather. Yet the cooling system must be able to maintain comfort under any conditions. Where machinery is installed on the job it must have sufficient capacity for the peak period, although this may total only a few hours per year. The average operation throughout the cooling season is invariably much less than the peak load and at the same time the cooling season is relatively short. On this basis the load factor on the refrigeration side of a single comfort-cooling installation is exceedingly low.



Ice in the basement, comfort upstairs

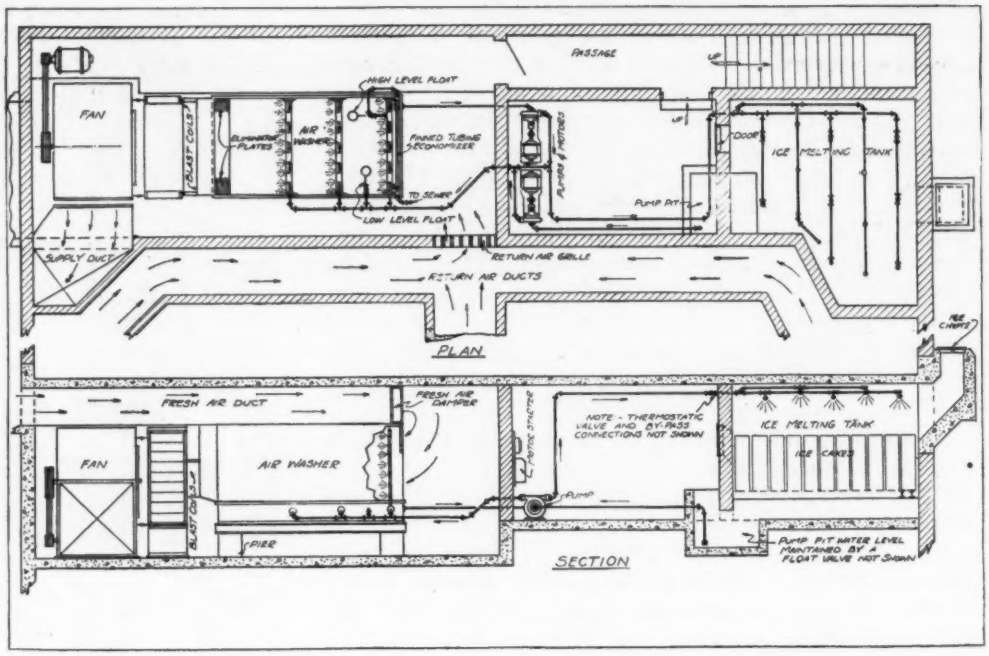
From the melting ice in the tank cold water is pumped to the built-in washing and cooling units. Air is drawn through the bottom grille, is washed, cooled and, if desired, dehumidified by the spray and is discharged at the top. A number of these installations with Betz unit air cooler equipment are now in use.

Through the use of ice in comfort cooling a large number of installations are grouped as to refrigeration requirements and the diversity of these is reflected in the steady, 24-hour operation of the ice plant. Then, too, the sale of ice for comfort cooling is in addition to the sale of ice for other uses. The machinery in the ice plant thus operates on a relatively high load factor. In view of the fact that the fixed charges on the equipment are the greatest charge in ice manufacture, it is apparent that the item of load factor is most important. Where ice is employed for comfort cooling the ice plant absorbs the fixed charges on the refrigeration side of the operation.

Last summer iced-comfort-cooling systems were operated with great success in many fields of commerce, professional offices and in the home. The results on the basis of comfort considerations were perfect and the commercial users found, in addition, that the operation brought very profitable increase in business. The iced-

Typical ice installation for air conditioning

Substitution of the ice-melting tank for the power-driven compressor and cooling coils is the only difference between this installation and one for mechanical refrigeration. Air handling, circulation, washing, cooling and humidity control are the same in both cases.



comfort-cooling development was not new last year, because installations had previously been made, but the general interest of the ice industry was developed in 1931 and the bulk of the systems in operation were installed in that year.

Prior to that time the ice industry generally did not realize that the basic requirements of a comfort-cooling system are ice to produce cold water and electric power to drive the pump and fans. These are the two essentials, and the control of comfort conditions is only a matter of the use of simple standard equipment in which ice water cools the air and condenses out excess moisture, while the electric fan circulates the air through the cooled space. That is the whole story of how air conditioning or comfort cooling is accomplished with ice. Of course there are fundamental rules to be followed to prevent drafts blowing on the occupants from the cooled air in the distribution system. Then, too, the enthusiastic user must be educated in the fact that a 70 deg. dry bulb temperature inside does not necessarily produce comfort where the temperature outside is 90 deg. These are matters which have been worked out satisfactorily in many different types of installations.

The extreme simplicity, ease of operation and the absolute dependability which are inherent characteristics of the iced-comfort-cooling system have produced an entirely different conception of the whole summer cooling development. Comfort cooling is no longer available only to the larger business enterprise which has a high steady volume of patronage. The extreme simplicity mentioned before is reflected in low installation cost for the iced-comfort-cooling system. This cost is well within the present means of a large cross-section of commercial activity which needs the stimulation comfort cooling gives to summer business. The same characteristics will appeal to the professional men and bring about a wide use in their offices. The advent of the ice system has immeasurably widened the potential field for the use of

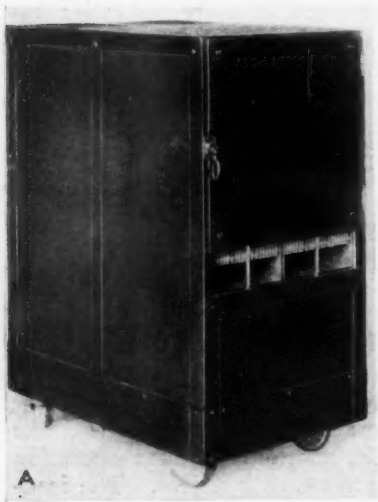
Direct contact, radiator, washer and filter type portable coolers

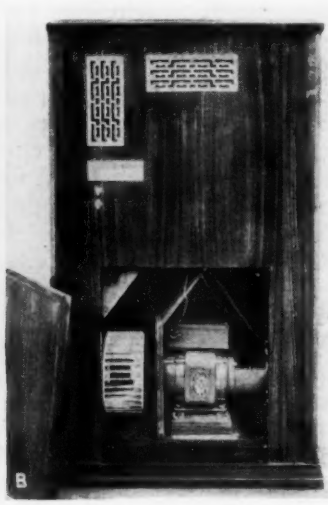
(a) In this Carrier unit the air is cooled by direct contact with the melting ice. Air is drawn into the front opening and is discharged at the top by a pair of small blowers.

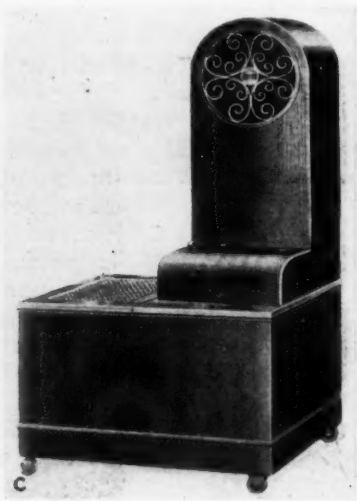
(b) Water from the melting ice is pumped through a multiple fin radiator through which the air is blown. This unit is manufactured by the Chil Aire Corporation.

(c) This is a Betz unit and is the same in operation as the permanent installation illustrated.

(d) Reduces the air temperature 12 to 15 deg., dehumidifies and changes the air at the rate of 350 cu.ft. per minute. Capacity, 250 lb. of ice.







comfort cooling, because it is no longer necessary to invest large sums of money in equipment to provide comfort in summer.

Operating cost is low

The ease and dependability of operation which iced-comfort-cooling operation affords are reflected in low cost of operation. This low operating cost is also of paramount importance in that it makes the system practical to use from an economic standpoint. Furthermore, a system which is to enjoy wide use in commercial, professional and the residential fields must be simple, dependable and trouble-free because it cannot expect to have expert attention to keep it in operation.

At the same time the ideal system must be flexible in operation because it is called upon to meet the widely varying demands imposed by summer weather. These requirements are never the same from day to day, but the user must be assured that, whatever the outside condition, comfort conditions will be maintained. The ice-melting tank is the cold source and the water to cool the air is provided and kept cold by constant circulation over the ice in the tank. This method produces refrigeration at any desired rate and the system is ready at all times to meet the demand which is placed upon it by conditions of the weather or some unusual condition in the cooled space. Therefore iced-comfort cooling has flexibility as well as the other desirable characteristics mentioned before.

A complete discussion of the greatly increased potential of the iced-comfort-cooling development, by virtue of the characteristics previously outlined, would require much more material than could be presented here. Yet a brief discussion of the basic factors has been presented and it will easily be possible for the interested utility man to satisfy himself on that score.

The National Association of Ice Industries has published a complete merchandising program on comfort cooling in seven separate sections. The first section of the program gives a complete description of the iced-comfort-cooling development which will answer a majority of the questions in the mind of the power man. This exposition of the subject is available through practically all of the ice manufacturers in the country; it will show how well the ice system is able to satisfy the need for comfort-cooling service in every field and give some idea of the potential development.

There are additional sidelights of the iced-comfort-cooling development which present a very appealing aspect to those interested in expanded power markets. It has already been pointed out that the development will bring a much wider application of comfort cooling. The wide acceptance of comfort cooling must inevitably lead to a wide use of year-round air conditioning. While winter air conditioning will not provide an additional market for ice, it will lower sales resistance for iced-comfort cooling in ratio to public acceptance of the desirability of constant control of inside atmospheric conditions. On the other hand, the electrical industry will benefit in increased measure through wide use of year-round air conditioning. The ventilating side of the system, with its fans and pumps, will be operated and consume power the year round. Since the refrigeration side costs so much less when ice is employed, many more users will be able to afford complete year-round air-conditioning systems. Their operation will further increase the power load from this source.

Looking at the whole iced-comfort-cooling development, the power man will see that quite without any effort on his part one of his major customers is developing increased product consumption which will in turn increase power consumption to a remarkable degree. Undoubtedly all power men will wish to make a detailed study of this rapidly expanding market for power. Such a study will show with remarkable clarity that they can well afford to extend their hearty co-operation in the development of iced-comfort cooling. A few of them will find that they can do so with great profit.

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Co-ordinated Light Sources Enhance Restaurant Attractions

Natural and artificial lighting through the horizontal clerestory windows supplement diffused bracket and side aisle cove illumination in the department store restaurant of T. Eaton & Company at Montreal, producing effective contrasts without glare and featuring the modernistic design of the establishment. Diffusing glass panels prevent the lighting units casting a shadow in the daytime.

Providing for Future in Building Wiring

By H. OSBORN and C. P. WOOD
Lockwood Greene Engineers, Inc., New York

THE McGraw-Hill Building is characterized by having daylight from all sides and more wall space devoted to windows than any other building, designed for similar occupancy, with which we are familiar. It is only reasonable to conclude that the occupants of such a building, accustomed to the benefits of good lighting during daylight hours, will be more exacting than might otherwise be expected in their requirements for artificial illumination. It was known in advance that considerable space in the building would be used for night operation, and it is probable that more and more space may be used at night from time to time. Therefore, it seems perfectly clear that a building so obviously well lighted in daytime should maintain the same relative advantages at night, or on cloudy days.

The following is quoted from a bulletin issued in 1925 by the Edison Lamp Works of the General Electric Company:

> It has been definitely proved that high-level lighting makes possible great increases in production or output. This condition is particularly true in the printing plant, where of necessity much work must be carried on under artificial lighting.
>
> An interesting example is that of the composing room of the McGraw-Hill Publishing Company of New York. It was found that, when its old system of local lighting with intensities averaging from 4 to 5 foot-candles was changed so as to give more general illumination with a 14 foot-candle average intensity, the composing room men received the change most favorably, and a much livelier atmosphere was in evidence.

It will be seen from the above that the operating force of the McGraw-Hill Publishing Company has been educated to the advantages of good lighting and that the new building would be expected to provide better conditions that the old building, which itself was considered exceptionally good.

The engineers considered it most important to provide a wiring system of ample capacity and so flexible that any future lighting requirements within reason would be fulfilled without changing the system of circuits, the size of wire or the spacing of outlets—all of these changes being very expensive compared with changing only the fixtures or the lamps.

The first thing to consider in laying out electrical work in a building of this character is to determine approximately what connected load may be expected. In this particular instance we assumed that there would be approximately 2 watts per square foot throughout the building, with the exception of the sixth, seventh and eighth floors, where operations* require a higher intensity of lighting. For these floors we allowed 4 watts per square foot. This gave us a total connected lighting load of approximately 1,100 kw. The power load was fairly definitely settled; the approximate amount of power required for house services such as elevators, house, sprinkler, vacuum and fire pumps was known. The power requirements for McGraw-Hill were known from the old plant and proper allowances were made for additional power needed for increased space in the new building. We also assigned a certain power load for each floor which would be rented. This, of course, was an indefinite item which might vary with different tenants. These facts determined in a rough way what we might expect as a total load.

The next consideration was the source of power. It was finally decided to buy steam from the New York Steam Company for heating and electrical power from the United Electric Light & Power Company instead of installing a power plant in the building.

Having determined that current would be bought from the power company, the service was established at the standard of 208/120-volt, three-phase, four-wire, alternating-current system.

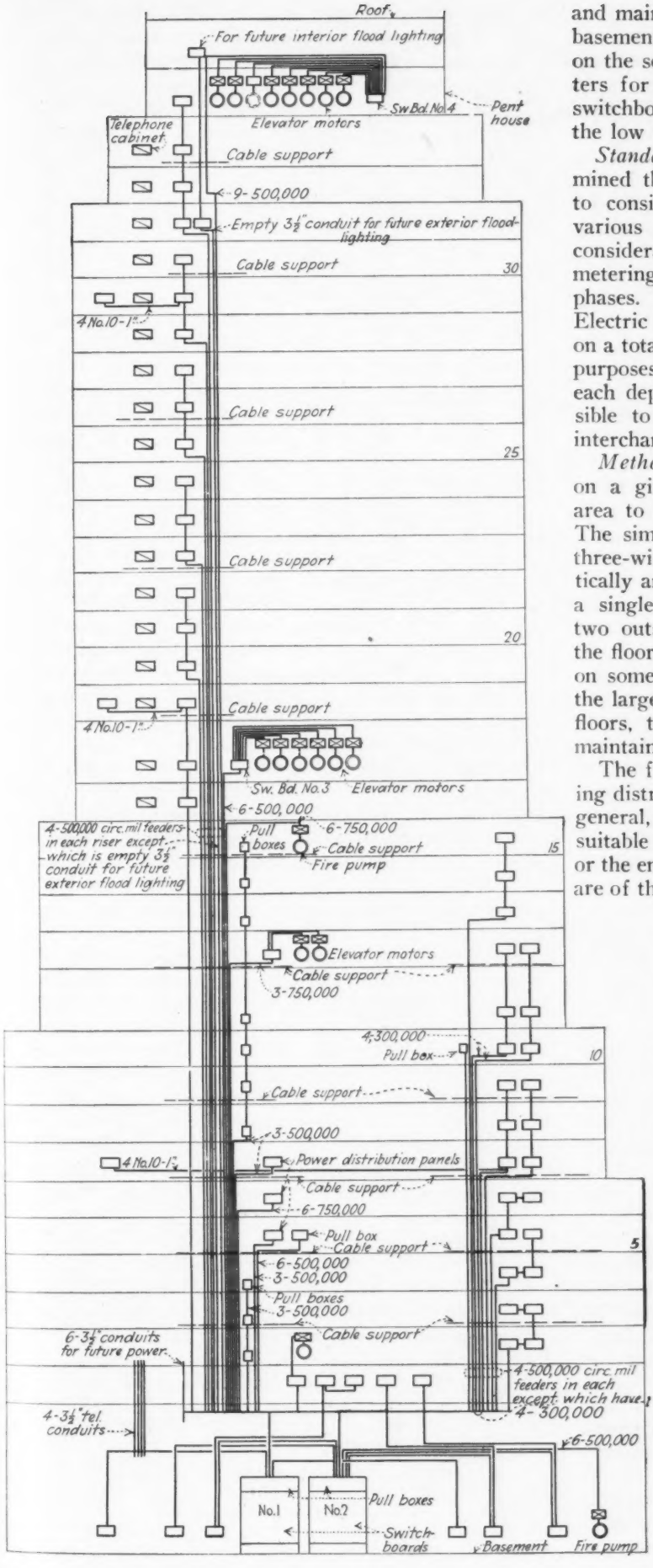
The estimated feeder capacity of this building is: Power, 2,950 kva.; lighting, 1,460 kva. The total capacity of the transformers is 2,000 kva.

Basement Substation Found Advisable—The next consideration was the location of the necessary substation or substations for the distribution of this current throughout the building. Up to within the last few years it has been common practice to install the service with the necessary transformers, control apparatus, etc., in the basement and to distribute from there throughout the building. The advent of the higher buildings has resulted in some of the latest and tallest buildings having substations at different elevations throughout the height of the building and distributing the power both up and down from these substations.

We made a very careful study as to which of these systems would be the most economical for the McGraw-Hill Building and reached the decision that in a building of this size and height, with the locations of its power load and the general distribution of its lighting load, 30 stories is about the economical limit of distribution from a basement substation alone. If the building had been slightly higher, or the power load distributed through the upper floors and not concentrated, as is the case in this building, on the lower floors, it probably would have been more economical to install another substation somewhere higher up in the building.

Therefore, the service transformers, network switches

**Composing, printing and binding.*



and main distribution switchboards were installed in the basement. There are switchboards in the penthouse and on the seventeenth floor which serve as distribution centers for the elevators. However, the current for these switchboards comes from the basement switchboard at the low voltage.

Standardized Interchangeable Meters—Having determined the starting point for the feeders, we had then to consider how these feeders should be run to the various panelboards on the floors above. The main considerations here were the owner's requirements for metering and the balancing of the power on the different phases. The total current purchased from the United Electric Light & Power Company is, of course, metered on a totalizing meter in the basement, but, for accounting purposes, the McGraw-Hill company wished to meter each department separately. We desired as far as possible to standardize on a meter that could be easily interchanged or taken out for testing, etc.

Method of Balancing Loads—The areas to be metered on a given meter varied from a comparatively small area to practically the whole of the large sized floors. The simplest method seemed to be to use two-element, three-wire, 25-amp. meters, which could be used for practically any load. Therefore, in the tower section we ran a single feeder to three floors, taking each floor on two outside phase lines and the neutral and balancing the floors on the feeder. This method was followed also on some of the intermediate floors. When we came to the larger floors, in general, we ran two feeders to three floors, taking half of each floor on each feeder, still maintaining the three-wire supply to each floor.

The feeders on each floor are brought first to a metering distribution panel which has fuse gaps convertible, in general, for 30, 60 or 100 amp., which gives combinations suitable for metering a small office, any part of the floor or the entire floor on the separate meter. The panelboards are of the two-wire type with neutral bus. The buses consist of copper links which can be changed and connected to give any combination of metering that may be desired. On the floors where there are two panelboards with two feeders there is a connecting conduit between the panelboards, so that, if necessary, circuits can be switched from one panelboard to the other for metering purposes. We believe that this method gives a very flexible arrangement and it has been worked out so that the loads are very accurately balanced on the phases.

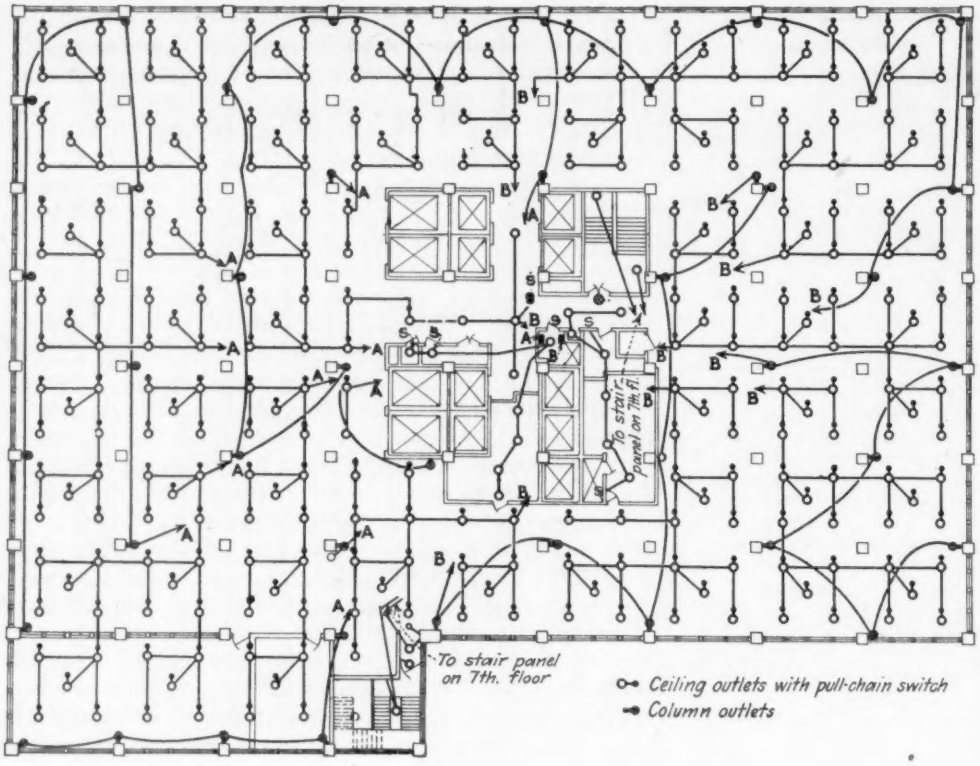
Power and light riser diagram

Running up through the first floor is a total of nearly 52,000,000 circ. mil capacity in risers.

Lighting—Above the seventeenth floor there are three floors on each riser. Below that level there are three half floors on each riser. All space on the first floor is on same feeder as basement. Note empty 3½-in. conduit terminating at 31st and tank house levels for future exterior floodlighting.

Power—Separate risers run to penthouse, seventeenth and twelfth floors for all elevators in these respective banks. The 200-hp. fire pump on the fifteenth floor is served by an independent riser. Pull boxes are provided for future tenants' power on the second to fourth and eighth to fifteenth floors. The fifth, sixth and seventh floors, devoted to bindery, pressroom and composing room, are each served by separate feeders.

Construction of the first floor corridor would have interfered with future installation of concealed conduits so six 3½-in. conduits are run up to the second floor for future power.



Outlets for typical large floor such as press or composing room

Some other large floors have only four outlets per bay. There is one circuit per bay with pull-ceiling switches on each unit. Receptacles provided on every other column (see curved lines for circuits); three receptacles on "wet" columns in four quadrants of each floor for drinking fountains.

Provision for Higher Intensities in Future—In regard to the lighting on the floors, after making our original estimates and after carefully going over the owner's requirements, we decided to increase the sizes of the feeders and branches so that, excepting the sixth, seventh and eighth floors, we would have 3 watts per square foot. This is somewhat higher than is customary, but we felt that this building should have facilities installed at the start for any intensity of lighting that might be installed in the future. The required lighting intensity, as we all know, is constantly rising and we did not feel that McGraw-Hill should be put in a position where in a few years the intensity of lighting might increase to a point where it would not be able to bring the lighting up to the standard.

The general arrangement throughout the building is four outlets per bay with a circuit to each bay. The sixth floor, which is the pressroom; the seventh floor, which is now the composing room and has been laid out for a future press floor, and the eighth floor, which will become the composing room when the seventh floor becomes a press floor, required a higher intensity. On these floors we installed five outlets per bay with a circuit to each bay.

Under-Floor Ducts Provide Flexibility—In addition to the general lighting, we have installed, from the sixteenth floor to the 33d floor, inclusive, a system of under-floor ducts consisting of two steel ducts with outlets on 24-in. centers. One of these ducts is for 120-volt service for use with accounting machines, etc., but is not intended to be used for auxiliary lighting on desks, which has been practically eliminated. The other duct is for telephone and signal service, bells, buzzers, etc. This under-floor duct system was given a great deal of thought. Several schemes were drawn up, one of which was for so-called 100 per cent coverage; in other words, the ducts were so arranged that no matter where desks were placed a duct would always be accessible. This was revamped on the basis that certain areas would, under most any occupancy, be devoted to aisles or filing cabinets, so 100 per cent coverage would not be necessary. Careful consideration was given to all probable arrangements of desks and we believe that we arrived at a solution which answers every purpose and is economical, as all desks when finally located could be served from the under-floor duct system without running cords across aisles or passageways.

Convenience Outlets Plentiful—Toilet lighting is simple, but effective. Each toilet is provided with an outlet for electric hand driers. Stairways are sufficiently lighted without any excessive cost, which is all that is required for this type of building. At each wet column† throughout the building, there is also a receptacle for use in connection with refrigerated drinking-water fountains. All of the manufacturing floors occupied by the McGraw-Hill company have utility outlets on every other column, including exterior and interior columns.

Special lighting conditions were encountered in the auditorium, executive offices and photographic laboratory. The lighting of the auditorium and executive offices was laid out after the details of these rooms had been worked out by the architect. The photographic laboratory has quite an elaborate system with special receptacles for carrying out the different processes.

Provision for Exterior Floodlighting—Provision was made for floodlighting the upper part of the building exterior with units located at three levels—the 32d floor, the penthouse floor and the tankroom floor. The total energy estimated for floodlighting is 113 kw. The feeder conduit, panel box and branch conduits to junction boxes on the roof were installed, but no wire was pulled in. We believe that the architects' idea on this is very good, namely, that the new building in itself is sufficient advertisement for several years, and that with floodlights at the start it would not draw much additional attention to the building, whereas if they were put in a year or two later continued interest in the building would be aroused. Floodlighting, therefore, will probably be installed at some future time.

Arranged for More Telephones—There is a very elaborate telephone system in this building. The service

†*Columns containing water pipes.*

enters in the basement and the main frame is located in a separate room in the basement. From this room the main telephone cable is carried up the shaft in the panelboard closets to the 24th floor, where the main switchboard, battery, frames, etc., are located. The present telephone switchboard is a five-position board, laid out for extension to a twelve-position board, and is equipped for 600 phones at the present time, with an ultimate capacity of 1,480.

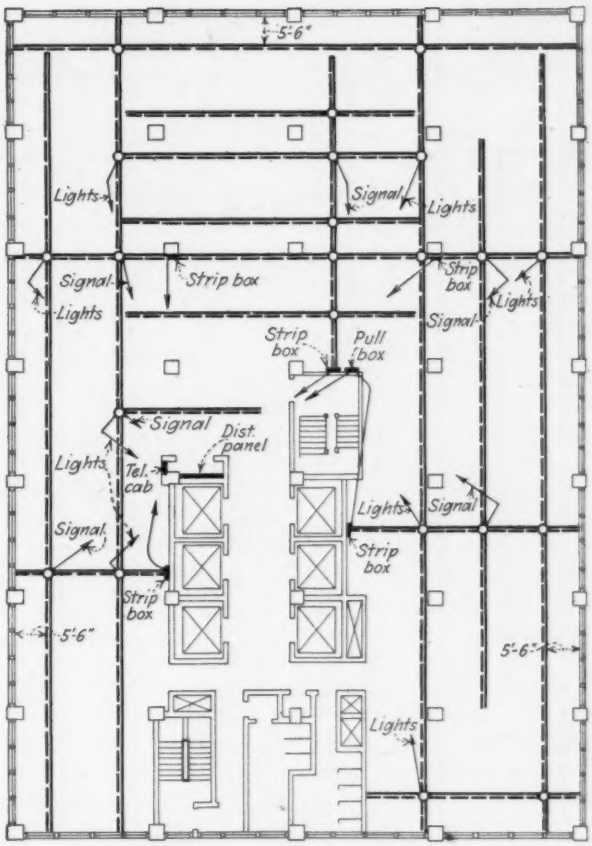
Signaling Made Flexible—There is also installed an auto-call system and clock system. These two systems are tied together through a program clock with the necessary apparatus so that the starting and dismissal signals can be given on the auto-call bells. The auto-call system is divided into three sections, because different departments operate on different schedules and start and stop at different times. Three circuits are also convenient because the operator can call a party on any one of these sections or all, as may be necessary, and because the auto-call bells in the executive section, for instance, need not ring when it is known that the party wanted is probably in the manufacturing section.

There is one feature in this connection that is rather unusual. We found that it was customary on such a system, when the time came to give a program signal, for all auto-call signal lines to be cut off a few seconds previous to the dismissal signal going out, the dismissal signal then being given over its proper line and all three circuits being put back on the auto-call system a few seconds after the sending of the dismissal signal. This meant that an auto-call signal might be interrupted in the middle of a ring and that the particular line not having the dismissal signal would be silent during the dismissal signal, and then cut in during the middle of the auto-call signal again, thus making it possible to have three distinct auto-calls delivered instead of one as was intended. We insisted on having this changed and finally succeeded in getting a system installed so that if a dismissal signal is going out over one of the three lines the auto-call signal will not be interrupted on the two other lines.

Inconspicuous Exposed Conduit—All power conduits from the riser shaft to the power distribution panels, starters and motors are exposed. Great care has been taken to have these conduits run so that they will be as inconspicuous as possible, and not obstruct the light. Conduits for the presses on the sixth floor and for the composing room on the seventh floor are run on the sixth floor ceiling. J. Livingston & Company, the electrical contractors, deserve recognition for their hearty co-operation, their careful attention to details and their consideration for the ideas of the engineers and owners, all of which contributed to the excellence of the work.

Committee Selected Fixtures—The selection of lighting fixtures was made by a committee composed largely of the parties interested in the lighting of each section. Many of the fixtures are the same as were in the old building, having been brought into the new building and installed. The fixtures for the executive offices and several other rooms were selected by the interior decorators.

The lighting fixtures listed have been installed. While the fixtures are very satisfactory and the lighting effects very good, we feel that the present lighting is more or less of a temporary nature. The capacity for any type of lighting has been provided so that any part of the building can be changed to vapor lamps, cove or indirect lighting or whatever combinations may be needed to produce the desired effect. As new types of fixtures and improvements in lighting sources are developed the McGraw-Hill Publishing Company may be expected to install them in this building, so that it will continue to be the latest word in illumination.



Underfloor ducts arranged for probable desk locations

Ducts are laid in duplicate, one for 120-volt service, dictaphones, office machines, etc., the other for telephone and signal circuits. Outlets are available at 2-ft. intervals so no cords have to be strung across aisles. Telephone cabinet is situated outside of shaft and power and light panelboard inside shaft.

Type of Fixtures Installed

	Floor
Special decorative fixtures made by the Miller Company and Black & Boyd	32 and 33
Graybar with semi-indirect reflex glassware, having clear crystal glass on top and lower half treated with silicate enamel	8, 22; 26-31
Duplexalite with 200-watt lamps, four per bay	18, 19, 23, 24, 25
X-ray with 200-watt lamps	16
Silvray with 200-watt lamps, four per bay	5, 6, 9, 11*
Silvray with 300-watt lamps, four per bay generally†	7
Benjamin R. L. M. with	
300-watt lamps, four per bay	3
50-watt lamps, four per bay	2
75-watt lamps	1‡
50 or 100-watt lamps	Basement¶
Special fixtures	Main corridor
Westinghouse Sol-Lux	All corridors except main.

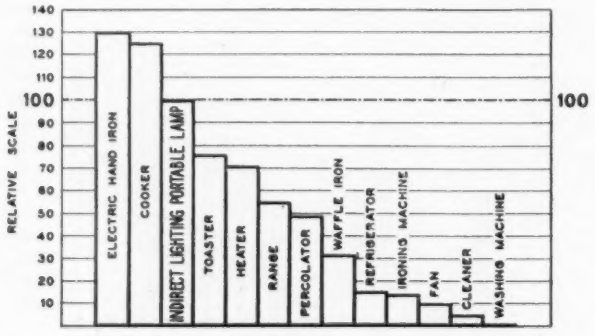
*Also in paper storage basement. †In some places five per bay. ‡Loading platform. ¶Except paper storage rooms.

READERS' FORUM

Indirect Portable Lamp Deserves More Consideration

To the Editor of the ELECTRICAL WORLD:

The editorial "Why Not Dimmers in the House!" published in the May 21 issue of ELECTRICAL WORLD, creates a mixed set of feelings in my mind, just as Mr. Frankl's original presentation of the subject did when I heard it in New York. The idea of providing all lighting requirements in the home with indirect portable lamps is commercially intriguing, for one might say at least a "cure-all," if you please, has been found. Furthermore, if ever there was a field in which a standardized lighting product was needed, it is in homes. Further contemplation reveals this kind of thinking to be faulty, however, for there is too much evidence from every phase of home arrangement, home furnishing, and too much variation in the temperaments of people to believe that every home will want, accept or tolerate indirect lighting throughout the home by means of floor or table standards. The physical characteristics of many interiors will alone prevent such a program, although I have felt that the indirect portable lamp can go a long way toward remedy-



Relative revenue building possibilities per dollar initially invested by customer

ing grossly faulty lighting conditions in great numbers of homes for a minimum cash outlay on the part of the user.

Our original home-lighting demonstration room built some thirteen to fifteen years ago at Nela Park had such lamps in it, but even at that time, as enthusiastic as we were for the indirect portable, we did not stop at that point, for the room also had other lighting arrangements in it, just as a room lighted from the charm standpoint as well as the utilitarian one has in it today. I rather regret that Mr. Frankl ignores or condemns the charm side of lighting, for light as a decorative medium possesses qualities that are not found with any of the media used by the decorator, and to infer that its development has no future possibilities, is indeed lacking in an appraisal of values.

Mr. Frankl, as well as your editorial, asks for a dimmer-controlled, 300-watt indirect portable, thereby giving no credit to the manufacturers, who, along with others, sensed this need several years ago. Both the Luminator Company in Chicago and the Lightolier Company in New York have had practical lamps on the market for at least a year which afford a choice of three or four intensities of indirect light. Mr. Frankl's clients can probably better afford to dissipate energy through resistance coils than the rank and file when it is light that is being purchased, and accordingly the manufacturers on the firing line have produced indirect lamps employing three and four 100-watt lamps, each subject to individual control. Cut-away section illustrations of some of these lamps will be found on page 86 of the book, "Artificial Light and Its Application in the Home."

Practically, the indirect portable lamp deserves a great deal more attention than it has received, for it can be an important tool in providing light for seeing in a great many instances, and since it can be purchased at reasonable prices, it possesses a unique position in the load-building program of any central-station company. When using initial cost of the device against revenue-producing possibilities, I find that the indirect portable lamp is only excelled by the electric hand iron and the cooker. This is illustrated on the inclosed chart (figures used obtained primarily from N.E.L.A. estimated consumption figures and averages of the prices of quality merchandise, 1930). The electric hand iron has reached a high degree of saturation, while the cooker may be considered a rather specialized piece of equipment, for its functions are largely provided for by other essential equipments in the home. This type of analysis places the indirect lamp in a very preferred position and one which it does not apparently possess in the thinking of the industry. However, should it reach a more recognized position, there are many reasons for believing that it should be a multiple-lamp device rather than a device with one single large lamp. I have followed the usages of these single-lamp devices in good homes and, for various reasons which I will not detail, the lamp comes into disuse or is used only in a limited way after the original novelty of it passes away.

This rather lengthy discussion is prompted more by desire to informally discuss the subject than it is to criticise. Under the circumstances Mr. Frankl's thinking is refreshing and was particularly so on the program on which it occurred, for he challenges many of the traditional architects, decorators and fixture manufacturers who insist upon making carefully scaled reproductions of candle fixtures for almost everything, completely forgetting the possibility of modern lighting and the feeling of a home at night.

E. W. COMMERY.

General Electric Company,
Nela Park Engineering Department, Cleveland, Ohio

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Lighting Reduces Traffic Accidents

Highway lighting on Bay Shore Boulevard, San Francisco, is credited with decreasing by 40 per cent the number of night accidents over a period of eight months as compared with the corresponding eight months of the previous season, according to data compiled recently by Kirk M. Reid, of the General Electric Company. Daytime accidents over the same period increased by 30 per cent on account of increased traffic. The 3-mile stretch of highway is equipped with 10,000-lumen units.

Men of the Industry

T. A. Kenney Heads Consumers Power Company

T. A. Kenney, for many years vice-president of the Consumers Power Company, Jackson, Mich., has been elected president of that company to succeed B. C. Cobb, who will continue to serve as chairman of the board of directors.

Prominent in two utility associations—the National Electric Light and the National Electric Railway—and widely

known outside these bodies as well, Mr. Kenney attained a well-earned augmentation of rank in the light and power industry when about four years ago he was elected a director and vice-president of the newly formed Commonwealth & Southern Corporation. Into this organization the Commonwealth Power Corporation, of which he had been vice-president, was merged.

At an early period of his life, Mr. Kenney entered the employ of the Hudson River Power Transmission Company, which afterward became a part of the Adirondack Water Power Corporation. Here he gained a knowledge of high-voltage transmission and local distribution lines and industrial power applications. Electric railway operation also came within the scope of his work, and he was abundantly qualified for higher responsibilities when in 1912 he joined the Hodenpyl-Hardy organization as manager of the production and transmission department of the Consumers Power Company. Four years later he went to New York City as assistant to B. C. Cobb, then in charge of operations for the Hodenpyl-Hardy properties. His progress was steady in the following years, until, in 1928, on the consolidation of these interests with Stevens & Wood, Inc., to form the Allied Power & Light Corporation, he became a vice-president and director. Later he assumed the same honors with the Commonwealth & Southern, into which the Allied company was merged.

A. C. MARSHALL, vice-president and general manager of the Detroit Edison Company, has been awarded the honorary degree of master of engineering by the University of Michigan.

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Dr. AMBROSE SWASEY of the Warner & Swasey Company, Cleveland, and founder of the Engineering Foundation, was made the recipient of the Franklin medal by the Franklin Institute of Philadelphia in recognition of his development of methods and his invention of appliances for making machines, tools and instruments of the highest precision, of the design and construction of the mountings of many of the world's largest telescopes and of his scientific vision in the establishment of the Engineering Foundation for the promotion of research and its application in the various fields of engineering.

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JAMES L. MCQUARRIE, vice-president and general technical director of the International Telephone & Telegraph Corporation and of the International Standard Electric Corporation, has completed 50 years of service in the communication industry and retired July 1. Forty-three years of this period were spent with the Bell System and the last seven with the International. Mr. McQuarrie has more than one hundred patents to his credit. He is a fellow of the American Institute of Electrical Engineers. During his visit to Tokyo, in 1920, he was decorated by the Emperor of Japan with the Order of the Rising Sun.

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OBITUARY

Dr. GEORGE K. BURGESS, internationally known physicist and for the past nine years director of the Bureau of Standards, died, as the result of a cerebral hemorrhage, July 2 in Washington, D. C., in his fifty-ninth year. He entered the service of the government more than 25 years ago and advanced steadily from assistant physicist to director of the bureau. His outstanding achievements were in the field of metallurgy and to this branch of scientific literature he contributed extensively. Dr. Burgess was a past-president of the American Society for Testing Materials and the American Society for Steel Treating. He was a director of the American Engineering Standards Association, a member of the foreign service and engineering committees of the National Research Council, of the American Institute of Mining and Metallurgical Engineers, a fellow of the American Association for the Advancement of Science and an honorary member of the Japanese Society of Mechanical Engineers. In 1929 he was a delegate to the World Engineering Conference in Tokyo.

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R. B. Williamson

Robert B. Williamson, electrical engineer and for 27 years a member of the engineering staff of Allis-Chalmers Manufacturing Company, died at his home in Milwaukee June 26. Since 1910 Mr. Williamson had charge of the design of all alternating-current rotating machinery built by Allis-Chalmers. This period was one of great expansion in the electrical industry, marked by machinery of ever-increasing size, and many of the machines designed under his supervision have established world's records for size and efficiency.

Mr. Williamson, who was born at Smith's Falls, Ont., 59 years ago, was graduated from Cornell University, Ithaca, N. Y., in 1893. Two years in electrical construction work were followed by two years as chief draftsman for the Canadian General Electric Company. During the three years from

1897 while serving as instructor in electrical engineering at Lehigh University, Bethlehem, Pa., the text book Alternating Currents was written with Prof. W. S. Franklin as joint author. This, for a score of years, was the standard text book in leading engineering colleges.

From 1899 to 1905 he served as principal of the department of electrical engineering of the International Correspondence Schools, and joined the Allis-Chalmers organization at the Norwood, Ohio, plant in 1905.

Mr. Williamson was a fellow of the American Institute of Electrical Engineers, serving a term on the board of managers of the Institute, also on a number of important committees, and was a frequent contributor to its technical publications.

New Equipment Available

Starting Switch with Overload Protection

A new compact, manually operated switch that will start and stop small a.c. motors and give overload protection has been developed by the Allen-Bradley Company. The switch has two overload relays, and tripping of either relay opens the contactor and completely disconnects the motor from the line. It is made in two sizes; size one, which is the smaller, has three poles, and size two has three and four poles; size one will handle self-starting single-phase motors up to 1 hp., 110 volts, and 2 hp., 220 volts, and polyphase motors up to 2½ hp. at 220 volts, 440 and 550 volts. Size 2 switch is rated at 5 hp., 220 volts, and 7½ hp., 440 and 550 volts, for two- and three-phase motors.

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Star-Shaped Copper Ground Rod

A star-shaped solid copper ground rod, designed especially to combine mechanical strength with a high resistance to corrosion, has been announced by the Anaconda Wire & Cable Company, New York. In addition to increased mechanical strength, the star-shaped section provides a large contact area per unit of weight and furnishes a simplified means for connecting ground leads.

Being of homogeneous construction of solid copper, this ground rod is said to be free from all galvanic actions.

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A TIME STARTER designed for mining service for use with non-reversing, constant-speed direct-current motors on pumps, fans, hoists, all kinds of conveyors, loading machines and all types of mining machines is announced by the Westinghouse Electric & Manufacturing Company. By use of a recent development known as the "Timetactor" definite time-limit acceleration is obtained without the necessity of intermediate relays. The new heavy-duty contactor provides a new and highly effective arc-rupturing capacity and reduces burning of contacts to a minimum.

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A NEW HEATPROOF CONNECTOR PLUG, said to be revolutionary in basic principle, has been announced by Cutler-Hammer, Inc., Milwaukee, Wis. This plug has the contact pressure springs on the outside of the case. The contact clips proper have no springs wrapped around, nor any springiness. The outside springs also serve to hold the halves of the connector together and eliminate the two screws and nuts commonly used for this purpose. It is claimed that this new construction remedies the basic fault of previous connector plugs by shielding the springs from heat instead of confining the heat around the springs.

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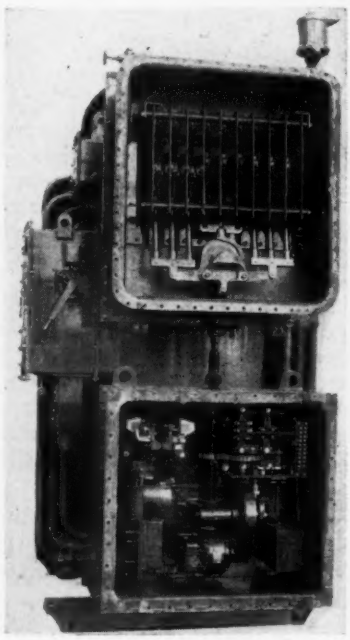
Tap Changer for Single-Phase and Three-Phase Ratings

A new tap changer which makes it practicable to apply tap changers to transformers as small as 500 kva. per phase and is suitable for both single-phase and three-phase ratings is announced by the Westinghouse Electric & Manufacturing Company. The three-phase rating forms a part of the standardized equipment for primary distribution service, including a three-phase transformer with potheads, metal-clad switchgear with necessary relays and other equipment that go to make a complete distribution unit.



Some of the advantages claimed by the manufacturer are that it is simple and reliable, suitable for automatic operation in response to voltage and load changes, does not add reactive burdens to the circuit and permits the desired voltage steps at any load or power factor, etc.

The tap changer consists of selector switches for selecting the proper transformer tap, transfer switches for transferring the load from one tap to another and a motor-operated mechanism with its equipment for automatic operation. The use of three transfer switches to perform all load switch operations is a feature of this tap changer, giving an orderly and safe scheme of switching which prevents arcing on the selector switch units even under the worst abnormal condition.

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Dust Collectors for General Applications

Framed bag dust collectors designed for general applications, but which fit into each specific need as well as if they were specifically designed and engineered for that service alone are announced by the Blaw-Knox Company, Pittsburgh, Pa. Some of the features of these collectors are: A simple wrapping type cloth bag seal, requiring no tacks, nails or screws, two bolts only being used; minimum number of parts per square foot of cloth area; greatest unit of capacity and largest cloth area per square foot of ground occupied, and the largest cloth area per lineal foot of arrester.

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One Antenna Now Serves 3,000 Radio Receivers

As many as 3,000 radio receiving sets can operate independently on the same antenna without interfering with each other with a system which has just been perfected, according to an announcement by the Western Electric Company, New York. By adding further apparatus, the number of sets can be increased indefinitely without impairing the quality of reception.

The first requirement of the system is a properly constructed antenna. It is connected to a transmission line several hundred feet long through a panel which consists essentially of a suitable lightning arrester, a terminal strip and a repeating coil designed to transfer most efficiently the energy collected by the antenna to the transmission line. The transmission line running from this panel to the amplifiers is one of the vital features. It is a coaxial conductor, or a conductor within a conductor.

The transmission line terminates in a selective volume control panel. This includes five adjustable filters designed for use with a low impedance radio frequency line. The filters reduce the signal strength from nearby radio stations to prevent overloading the radio receivers and amplifiers, without reducing the signal strength from other stations. The panel is associated with a power amplifier of the four-stage, neutralized, untuned, push-pull type. This amplifier has a sufficient gain and power capacity to supply 750 radio sets and the system can utilize four such amplifiers, bringing the total sets to 3,000.